SCIENTIFIC AMERICAN

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A NOVEL FEATURE IN MINING.

At the Arroyo Seco Mine, about three miles from the town of Ione, in California, there is now in operation an entirely new method of placer mining. This mine is situated in the bed of a dry creek which at some remote period had been a river course and had been gradually filled, by the erosive action of the water, until the gold-bearing gravel lay buried under about twenty-five feet of dirt and stone. This "pay dirt" as it is called rests upon bed rock, is from five to ten feet in depth, and quite rich. Although this property has been known to be worth working for a long time, no method of operating was devised until recently, on account of the great quantity of water lying near the bed rock, and for which no drainage could be obtained.

The principal feature of the plan now working successfully consists of a large crane, shown in the accompanying engraving, for moving the waste dirt. The engine and boiler room is built on wheels running on a track and contains two forty-eight inch upright boilers and a pair of 9 x 16 inch engines, placed on the same floor as the boilers. These engines move a reel carrying a 1⅛ inch steel cable, that runs out on the wooden boom and operates the box, as shown. The boom is 118 feet long, is 12 x 12 inches at each end, and is 12 x 24 inches at the center, is well guyed with steel ropes, and is strong enough to raise five or six tons of earth. Operations are commenced by first shoveling the top dirt into the box, then hoisting and swinging the boom at the same time, and finally dumping the dirt in a place completely out of the way. The engineer in the look-out house at the head of the mast attends to hoisting, swinging, and dumping the box.

Having thus exposed the pay dirt, water is conducted to the pipe to wash the gravel in sluice boxes, in the same way as that ordinarily pursued in placer mining. The water and sand, after leaving the sluices, flow to the sump, in which there are two submerged centrifugal pumps of peculiar pattern, and which were expressly designed for this work. Each of them has two 11 inch discharge pipes; the capacity is 600 miner's inches of water, or 900 cubic feet per minute. These pumps have no steps or bearings under water, the whole weight resting on two 26 inch anti-friction wheels. The vertical pumps are run directly by two 15 inch Knight turbine waterwheels, fed from the main supply pipe, the fall being of 74 feet. One of these pumps is capable of raising all the water from the mine, together with the sluice water; the other is used during the rainy season of the year.

This machinery was designed and made by Messrs. Knight & Co., of Sutter Creek, Cal., the patentees and manufacturers of the well known Knight waterwheel.

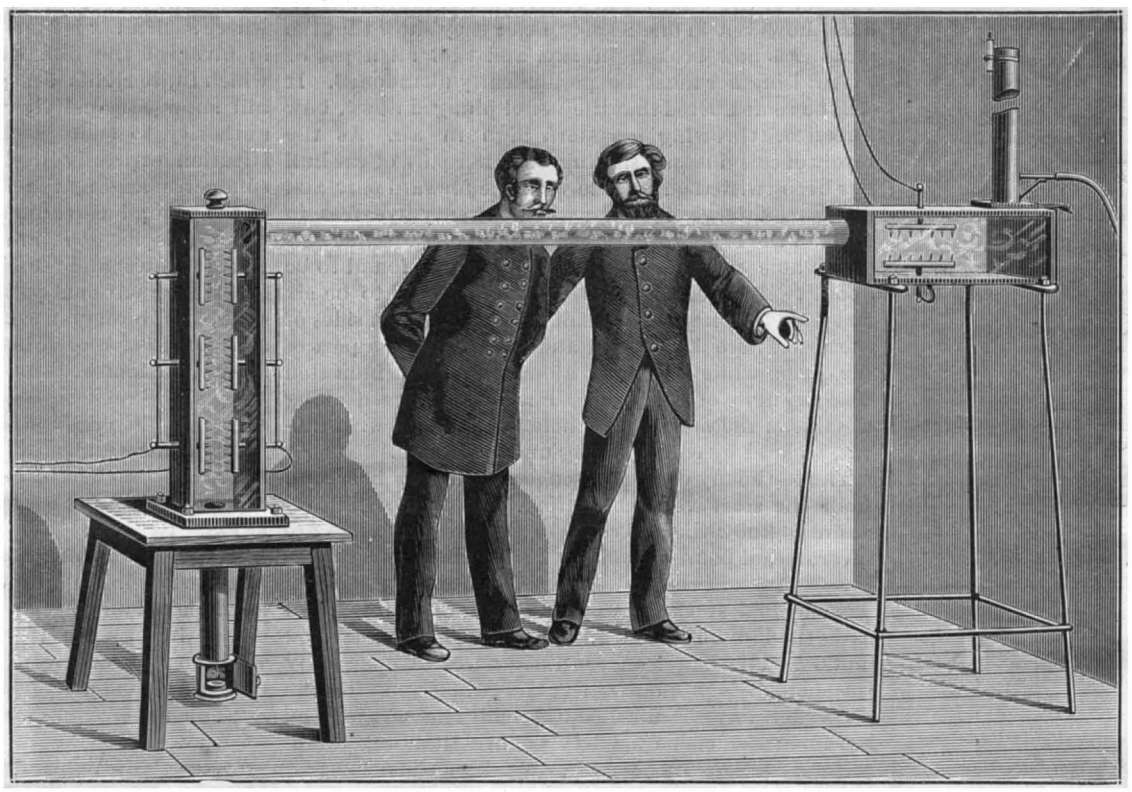

Fig 1.—LARGE APPARATUS FOR CONDENSING SMOKE BY ELECTRICITY.

SMOKE CONDENSED BY MEANS OF ELECTRICITY.

From Tyndall's experiments on the dust found in the air, Messrs. Clark and Lodge observed that a body at a higher temperature than its surrounding medium is enveloped in a thin stratum of air absolutely free from dust.

Mr. Lodge, of Liverpool, conceived the idea of studying this phenomenon, making use of electricity; he remarked that electrical discharges produced at high tension by a statical machine possessed the property of condensing dust and smoke of all kinds.

This was not slow in finding a ready application in metallurgy, for condensing the dangerous fumes and dust of lead in the factory of Messrs. Walker, Parker & Co., one of the largest of its kind in England. The results secured were remarkable, and the attention of students was particularly called to this new method of treatment, because it had a two-fold bearing—on the health of the workmen and on the economy of the process.

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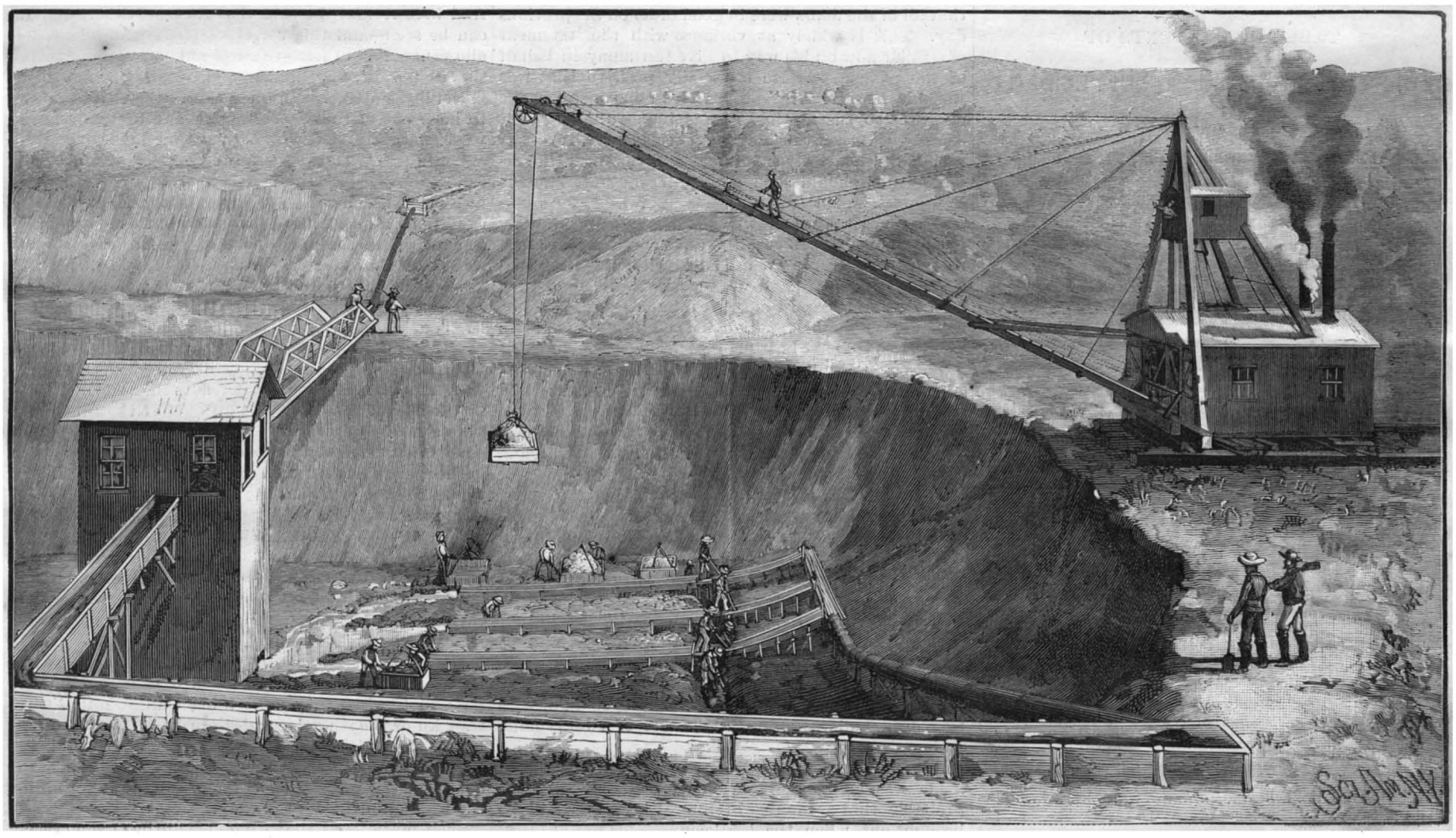

NOVEL MINING MACHINERY IN OPERATION AT THE ARROYO SECO MINE, CALIFORNIA.

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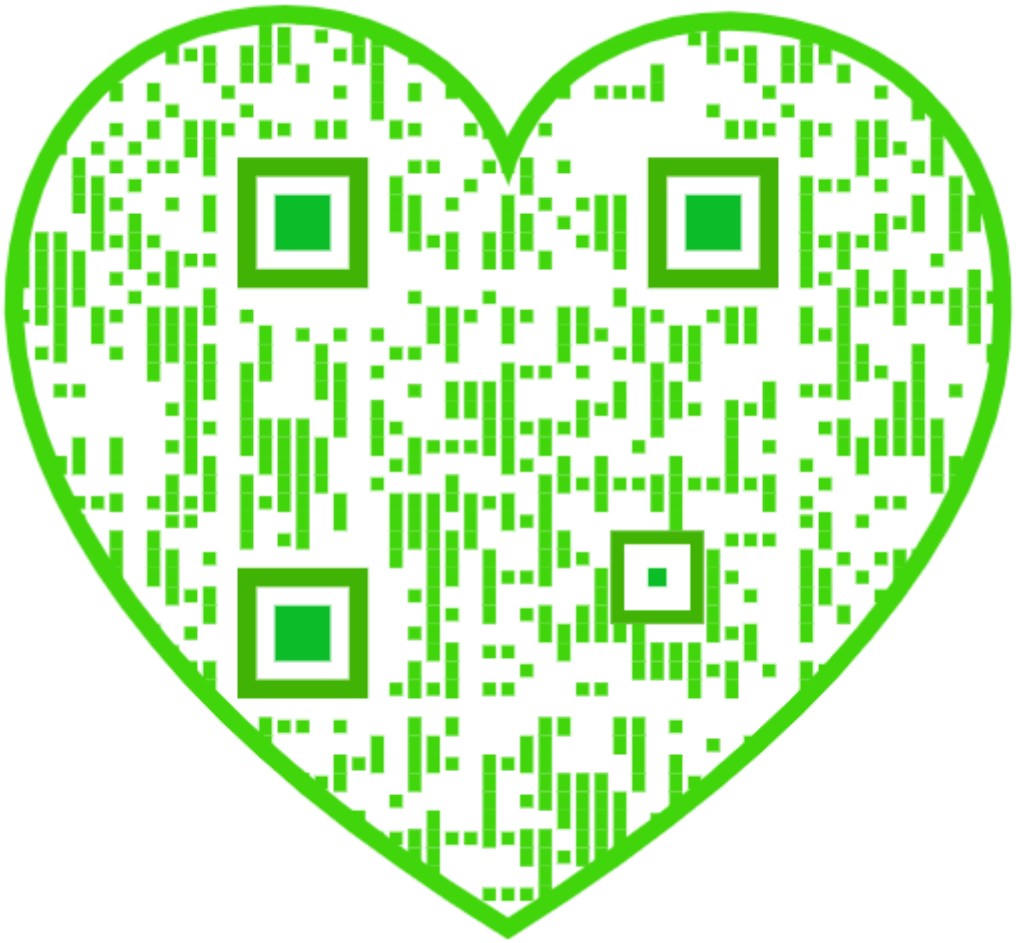

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NEW YORK, SATURDAY, APRIL 24, 1886.

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THE SINKING OF THE STEAMER OREGON.

Although more than a month has now passed since the Cunard steamer Oregon joined that large navy at the bottom of the sea, it cannot be said that the cause of the disaster has yet been satisfactorily explained. It is even uncertain what vessel gave the fatal blow. Circumstantial evidence still points to the Charles H. Morse as the unfortunate collier, since she would in all probability have been just off Fire Island Light at the time of the collision, and no news has been received from either schooner or crew.

It was thought that the steamer's share in the mystery would be fully explained as soon as divers could succeed in visiting the wreck and examining the present condition of the vessel. But a series of driving winds and consequent heavy seas made their work utterly impossible until a few days ago, when moderately smooth water permitted the first descent to be made.

In addition to this, the orders of the Cunard Company appear to have limited the investigation to the exterior of the vessel. The reports are of much importance, however, in one respect, since they show that the steamer is now broken in two, and that all hopes of ever raising her must be permanently abandoned. It will be remembered that the vessel plunged down, bow foremost, throwing her stern high in air. As the result of this unequal sinking, the after part of the hull has been twisted out of line with the forward part, and discloses a large opening about twenty-five feet in front of the bridge and on the port side.

The hole which sank the steamer was found to be about twelve feet below the main deck, and to be six feet deep by three and a half wide. The iron sides of the vessel were bulged in, and had crushed a part of the cargo, while scratches along the paint indicated that the fluke of an anchor had been dragged along the side of the vessel. The hole was covered with canvas, secured by cords passing under the keel.

The testimony of the passengers and crew has been from the start very conflicting. Beyond a natural desire to know the real cause of the disaster, there are several legal points involved which make a thorough investigation of the matter very important. All of the passengers lost their personal effects, and in several cases the individual loss amounted to many thousand dollars. The American representatives, at least, deny the company's responsibility; and while some of the passengers have been asked to submit statements, they have not been encouraged to believe that any voluntary reparation will be made. The legal responsibility, however, turns upon whether the sinking of the vessel was unavoidable or due to inefficiency on the part of the commanding officers. A very strong impression prevails on this side of the water that, had Captain Cottier and his subordinates exercised even a limited amount of presence of mind, the Oregon could have been kept afloat, and all these losses prevented.

Captain Cottier's own admissions before the Board of Directors at Liverpool show that one of the doors of the flooded compartment could not be properly closed, owing, he adds, to the volume of inflowing water and the coals washed against it. He states under oath that all of the doors were in good order on the previous day. This is widely at variance with the statement of a sailor now on his way to give testimony in behalf of the passengers. He is equally positive that this was not the case. He states that in one instance the door was so rusted that it was impossible to get it closed. However this may be, it seems incredible that such a comparatively small hole, and very near the surface at that, should send a magnificent craft like the Oregon to the bottom.

It is very easy, we know, when one is safely on shore, to say what *might* have been done; but, in this case, there was certainly a great deal which should have suggested itself to the mind of a commander whose very qualification for a post of so great importance should be dependent upon his resources in the face of danger. No effort seems to have been made to list the vessel by shifting her cargo or by blowing off the water from her port boilers, although all agree that such a course would have thrown the vessel sufficiently on her side to have lifted the hole above the water line. These omissions are the more inexcusable as all the attending circumstances were unusually favorable.

Even the simple expedient of beaching the vessel could scarcely have been tried in earnest. A very general doubt existed that any effort had been made until Captain Cottier stated before the Directors that his first idea was to make for the shore, but the putting out of the fires prevented his getting very near. People still feel, however, that the course he steered in carrying out such a plan was, to say the least, decidedly oblique. Everybody agrees in stating that the machinery worked for half an hour after the collision. The vessel at the time was so near the shore that lights could be seen from deck, and was going at the rate of twenty miles an hour.

It is odd that she now lies ten miles off Fire Island, if she was immediately headed for the shore. It is probable that a number of interesting facts will be brought out when the legal counsel for the unfortunate passengers presents the other side of the story.

INTER-STATE COMMERCE.

A bill is now before Congress which provides that the residents of each State and Territory may solicit orders for goods and merchandise anywhere within the United States without the payment of any license or mercantile tax. It was prepared by the Traders' and Travelers' Union of New York city, and introduced by Mr. James. At the present time fourteen States and Territories, besides the District of Columbia, impose such a tax upon the commercial traveler. The Union takes the ground that he is nothing more than an animated catalogue, and that while he displays his samples or other illustrations, and transmits orders to the home office, the real business transaction takes place at the desk of his employer. It maintains that any tax upon his performance of such a service is an evil which requires to be remedied. This position receives the support of the major part of the mercantile community and of the press, for the tax is regarded as an unjust restriction upon inter-State commerce. It is significant that many of the citizens of the localities where such a tax is imposed have declared themselves in favor of the bill. Recognizing the jealousy with which State rights are guarded, the advocates of the bill show conclusively that Congress has the proper authority to enact such a measure, since the Constitution expressly declares that the regulation of commerce among the several States is the function of the general Government, and the contracting parties in this instance are clearly the residents of different States and Territories. Believing, as we do, in a strong national policy, we hope to see the passage of the bill, both on account of its inherent merit and as an expression of unimpeded intercourse between the several commonwealths of the republic.

SIGNALS AT SEA.

In the last number of this journal, a correspondent, referring to the recent disaster to the Oregon, offers a suggestion looking to the prevention of such collisions at sea. He says:

"I would suggest that all steamers carry an additional white headlight on their bow, furnished with movable red and green screens, that can be quickly drawn in front of the light (thereby changing the white to a red or green light) by wires running from the light to the pilot house.

"The wheelsman of a steamer, seeing a sailing vessel near, can decide on which side he should pass; if to 'starboard,' he can quickly draw the green screen in front of the light, thereby notifying the sailing vessel that she is to pass to the 'starboard' side; or if the wheelsman considers the 'port' the proper side to pass, he could draw the red screen, then the navigator on the sailing vessel could quickly know on which side the steamer intended to pass."

It is not easy to see how such a system of signal lights could serve to lessen the danger of collision. Indeed, it would seem—and the writer asks pardon for the remark—as if it would add to them. If the present rules are to be changed, it is manifest that whatever code succeeds should be equally simple. And here it may be said that in cases where lights can be seen—and this correspondent's plan makes no allowance for others—there is not, or, rather, there should not be, any difficulty in avoiding a meeting. Generally stated, the present rules compel a steamer to keep out of the way of a sail, and of two sailing vessels meeting, that with a free wind must give way. When a great steamer like the Oregon, running at full speed, meets another vessel in foggy weather or in a haze, which seems to have been the prevailing conditions at the time of her mishap, there is no reason to believe that any code of signal lights would avail to arrest disaster. A ship which, with her helm hard down, does not fairly begin to respond until the end of half a mile's run, can scarcely be expected to keep out of the way of another vessel when sighted close aboard.

Again, sailing vessels cannot always go as they will, their movements being restricted by the wind. A vessel close-hauled and jammed up against the wind cannot be turned any further in the direction whence the wind is blowing, without stopping her headway and leaving her helpless and unmanageable. Hence, to signal to such a vessel to "pass to the port side," as suggested, would, if such "passing" was to windward, be idle, if not positively ridiculous.

It is true that the masters of these big steamers do pretty much as they please on the high seas, and are not inclined to confine themselves to a strict interpretation of the rules of the road. If proof of this were wanting, it might readily be found in the letters recently sent to the press by the skippers of coastwise craft. These men allege, in effect, it has come to that pass that, when they meet a big transatlantic liner, they know the sea-going rules are "off" for the time being. Experience has taught them that she will hold her course, willy nilly, and it only remains for them to get out of her way—to sheer off or even to luff up into the wind and let their sails flap.

Such mishaps as that which befell the Oregon seem not to proceed so much from any defect in the sea-go-

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ing rules as from a wanton disregard of their observance. To run a great, unwieldy hulk at high speed in foggy or even hazy weather on a commercial highway, where scores of sail continually ply, seems to be a greater offense than a fine will atone for. It ought to be criminal. The men who are responsible for this flagrant violation of the law boldly affirm that there is no more danger in running at full than at half speed in thick weather; and the course of reasoning by which this conclusion is reached, if not logical, is at least unique. If we run at half speed, they say, we may only come up in time to run head on to a vessel crossing our track, whereas, had we been going at full speed, we would have safely crossed her bows and been on our way with plenty of sea room.

A fair answer to this would seem to be that the slower a steamer is going the more chance there is of avoiding collision when it is imminent. The law says that a steamer sailing in thick weather shall go at half speed and keep her whistle going; and a careful navigator, more concerned in the safety of his own ship and the craft that may be in his path than in making fast time, will stop his engines when he hears the whistle of a steamer or the horn of a sailing vessel, while he locates the direction of the sound, and then keep his engines turning very slowly—only fast enough to insure steerage way—until the danger is over. No system of signal lights could be of much service in thick weather at sea, because they are rarely seen until it is too late for effective warning; and as, when strong winds prevail, a vessel with the wind behind her cannot hear sounds from a-lee, it is the duty of those sailing in the teeth of the wind, as the master of the Oregon was, to go very slow and take more than the usual care.

Not long ago a trial was made of a code of sound signals to be used in fogs at sea; these being made up of short and long sounds blown by steam or horn, by which the course of a ship hid by the fog could be sent to one that was likely to meet her. A short sound meant, "I am out of the west by north," or, in other words, "I am bound east by south." If the wind never blew when it was thick, this would have been a great help at sea; but the fact that, save when the wind is dead ahead, sounds do not come true from the point whence they start, but are heard first over one bow and then over the other, would do much to make this plan of no avail, and so, though it found much favor ashore, did not gain any friends at sea.

THE CLAPP-GRIFFITHS STEEL PROCESS.

In our article on the Clapp-Griffiths steel process, March 27, we inadvertently transposed the reactions occurring in the Bessemer converter. It is the silicon of the pig iron which first suffers combustion, and forms with the oxides of iron and manganese a siliceous slag which floats upon the molten metal. The carbon then oxidizes, and the disappearance of this flame indicates the end of the reaction.

PHOTOGRAPHIC NOTES.

Directions for Making a Gelatino-Bromide Emulsion by the Ammonia Method.—Mr. W. K. Burton in the *Photographic News* says: I have always rather avoided giving ammonia formulæ for emulsion making because, although I have been able to get the highest degree of sensitiveness by this method, I have not in my own practice been able to find any method whereby I could be sure of producing an emulsion free from green fog. The introduction of the alkaline carbonates in place of ammonia in the developer has, however, made the appearance of green fog a matter of comparatively little importance. Even if the carbonates be not generally used, the photographer may make use of a carbonate developer—such as Beach's—when he finds that he has had the misfortune to get a batch of emulsions showing green fog.

The following is a formula which has given excellent results:

A.—Nitrate of silver	200 grains.
Water	2 ounces.
B.—Bromide of potassium	160 grains.
Iodide of potassium	10 "
Nelson's No. 1 gelatine	40 "
Water	4 ounces.
C.—Dry gelatine	300 grains.

Into A is poured very slowly the strongest ammonia, or the stock solution of one part strong ammonia, one part water. Darkening of the solution will immediately take place. The addition of the ammonia is continued, with constant stirring, till the solution just becomes clear again, which will probably occur when about half an ounce of strong ammonia has been added. The clear solution now obtained is called ammonia nitrate of silver. It has to be made up with water to a quantity of four ounces.

When the gelatine in B is soft, the whole is heated till the solution reaches a temperature of about 160° Fah. It is then allowed to cool to 120° (a chemical thermometer must be used in this process), when emulsification is performed by pouring A *cold* into B, in three or four operations, with stirring after each.

The jar containing the solution is now placed on one side to cool, the gelatine, C (still dry), being placed in a separate jar. When the emulsion is cool, it is poured over the dry gelatine, which will, of course, soften in it as it would in cold water. About twenty minutes will be sufficient for the softening. After the lapse of that time, the jar is placed in water at 140° Fah. till the gelatine is melted. When the solution is complete, the emulsion is set on one side to get stiff for washing.

If, immediately after emulsification (that is, after the two solutions are mixed), the jar be placed for twenty minutes in water at 120° Fah., and be after that placed on one side to cool slowly, a rapidity of double the average should be got.

If the temperature be 140° in place of 120°, quite four times the average (or table) rapidity should be the result; but when digestion is carried on at this high temperature, it is almost necessary to have recourse to "precipitation with alcohol," otherwise the finished emulsion will be so thin that a good film cannot be obtained.

Before going on to a description of the precipitation, let me say that while the emulsion is digesting—or "stewing," as it is generally termed—at 120° or 140°, and afterward till it gets pretty cool, it is necessary to stir it vigorously every five minutes, otherwise fog is likely to make its appearance.

To precipitate, the following is the procedure:

For the quantity of emulsion given above, twenty ounces of methylated spirit are poured into a jar holding at least thirty ounces. A glass rod is held in the left hand. The emulsion, in place of being allowed to set and being washed, is allowed to cool only to about 100° Fah. The jar containing it is taken in the right hand, and the emulsion is poured in a thin stream into the methylated spirit, while this latter is continuously stirred with the glass rod. As soon as the emulsion touches the methylated spirit, it is deprived of almost all its water, and falls down in a thick mass of a consistency somewhat resembling soft India rubber. If the glass rod be properly manipulated, the whole of this sticky stuff will cling to it. The greater part is sure to, but it is well to dip the hand into the methylated spirit after all the emulsion has been poured into it, and to remove any which may be sticking to the bottom. This is added to the lump of emulsion on the point of the rod, when the lump is squeezed just as a sponge is squeezed, till all the spirit possible is squeezed out of it. The size of mass will now be surprisingly small—very little larger than a walnut. This mass is torn up with the fingers into pieces about the size of a pea, which are dropped into a jar of clean water, where they remain for twenty-four hours, the water being changed several times. At the end of twenty-four hours the pieces of emulsion—which will have swelled very considerably—are placed in a small jar, water being poured over them to make the quantity up to eight ounces. Heat is applied to melt the whole. Half an ounce of alcohol (not methylated spirit) is added, and the emulsion is ready to spread on glass.

In coating with this emulsion it is advisable to have it as cool as possible—not over 100° Fah. If it will not run on the plate as cold as this, these must be very slightly warmed before the coating operation commences. By the process just described, emulsions giving plates of a sensitiveness 25 on Warnerke's sensitometer, and at the same time giving clear shadows and ample density, have been produced many times in succession. This sensitiveness is very high, but it appears that such plates do not keep so well as those of more moderate rapidity. They are liable to show a slight fog after having been stored for a few months.

I can recommend Beach's developer for plates prepared in the way just described.

Note.—The developer referred to is prepared as follows:

No. 1. PYRO SOLUTION.

Warm distilled or melted ice water	4 oz.
Chem. pure sulphite soda (437 grs. to oz.)	.4 "

When cooled to a temperature of 70° Fah., add:

Sulphurous acid	3½ oz.
Resublimed pyrogallol (437 grs.)	1 "

The pyro is best dissolved by pouring the sulphite solution into the pyro bottle and then out into a graduate, repeating the pouring until completely dissolved.

If pure, it will dissolve very rapidly. When completed, the solution should measure nine and a half fluid ounces.

No. 2. POTASH SOLUTION

is prepared with two separate solutions as follows, each ounce of the salt containing 437 grains to the ounce:

a	Water	4 oz.
	Chem. pure carbonate of potash	3 oz.
b	Warm water	3 oz.
	Chem. pure sulphite soda	2 oz.

a and *b* are now combined, forming one concentrated solution.

Each ounce of No. 1 contains approximately 48 grains of pyro. Each ounce of No. 2 contains approximately 154 grains of potash.

It will be seen that the potash solution is quite concentrated, so that a small quantity is only necessary for use in development.

A normal developer would be made up as follows:

Water	2 oz.
Pyro solution (No. 1)	1 drachm.
Potash solution (No. 2)	30 minims.

If more density is required, from one to two drachms more of No. 1 may be added. If the development proceeds too slowly, from one to one and a half drachms of the potash solution may be added in small quantities at a time, until the right speed of development is attained. By thus varying the proportions, the developer can be made to suit either an over or an under exposed plate.

The negatives possess a brilliant, clear, bluish gray color.

Government by Snap of the Finger.

A few days ago a cigarmaker walked into the office of Mr. William Strange, of Paterson, N. J., who employs 1,200 persons in his large silk mills, and demanded that he sign an order which would revolutionize the dyeing shop. Mr. Strange declined to do so, whereupon the cigarmaker at once went out, and as he passed the dyeing shop snapped his fingers, at which signal all the operatives in the shop dropped their work and left the premises. They subsequently admitted that they had no grievance, and that they were indignant at being ordered to stop work, but they claimed that under the laws of their labor organization they had no option.

Mr. Strange, who seems to have acted coolly and fairly, told his people that he could not do business on that plan. If it had come to this, that a stranger and an outsider could walk along the corridors of his mill and stop all the work he had in hand by a snap of his finger, he would shut up his manufactory and employ his capital in other ways. And he should do this, not in passion or out of spite, but because he could not afford to do business under such conditions. He would not feel justified in assuming the responsibility of contracts, in making investments in real estate and machinery and the like, if his whole business could be paralyzed at any moment at the whim of a dictator.

The love of power is an instinct with all, and it is not surprising that the labor element, now that it sees the strength to be derived from association, should like to use that strength more or less wantonly. But ignorance and passion will ruin any cause. Labor can only be really strong by being right. And the labor cause will break down unless it studies the principles of human society and obeys them. In the case just cited, if the facts are as reported, these fundamental principles of liberty and order were ignored; and the result can only be confusion and ruin. Whatever the remedy for labor troubles may be, certainly it is not the snap of the finger.—*N. Y. Commercial Advertiser.*

Hypnone.

In a recent number of the *Bulletin General de Therapeutique*, Dr. Dujardin-Beaumetz and Dr. G. Bardet give an account of the physiological action and therapeutic uses of a substance to which they propose to apply the term "hypnone." It has many names, the best known being acetophenon; but although they may be useful as indicating its chemical composition, they are ill adapted for the requirements of the practical physician. It is made by distilling together a mixture of benzoate and acetate of lime. At ordinary temperatures it is a clear, colorless liquid; but on exposure to even a moderate degree of cold, it is converted into a mass of beautiful crystals.

It is simply a laboratory produce, and as yet has not been manufactured for commercial purposes. Its price is somewhat high; but as the dose is small, this is a matter of little importance. It has a most persistent characteristic odor, so that few patients would care to take it unless inclosed in capsules. Its physiological action is very marked, and there is reason to suppose that we are in possession of a hypnotic only second to urethan. In cases of simple insomnia, unattended with pain, its action is marvelously prompt, and there are absolutely no after-symptoms, such as nausea, headache, or constipation, which so frequently follow the administration of opium or morphia. It has as yet been but little used in this country, but the reports so far are said to be most favorable. We owe a debt of gratitude, says the *Lancet*, to Dr. Dujardin-Beaumetz for giving us this new remedy.

THE *Age of Steel* has been informed that the Brush Electric Company, of Cleveland, are building the largest dynamo in the world. It will be 12 or 13 feet long, 5½ feet wide, and weigh ten tons. It will give a current of 122,500 amperes; number of watts, 245,000. In other words, it will be four times the size and capacity of the "Jumbo" machine exhibited by Edison at the Electrical Exposition at Philadelphia. The latter was adequate to the task of running 5,000 sixteen candle power incandescent lights. This monster machine of the Brush people will be shipped to Lockport, N. Y., and used for the smelting of "aluminum," it is said. Five hundred horse power will be required to drive it, which will be furnished by water, with the aid of turbine wheels.

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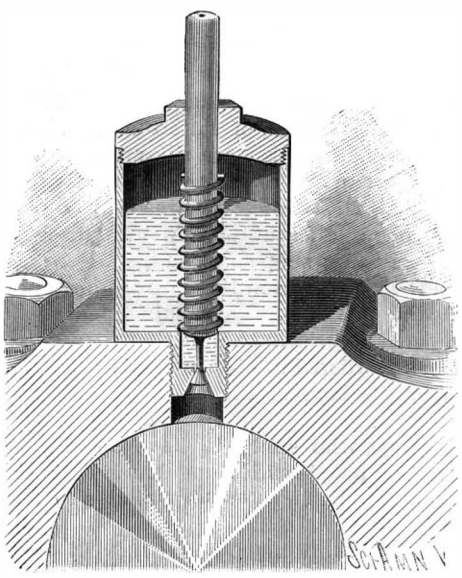
IMPROVED OIL CUP.

This simple and effective device is for supplying oil to the bearings and other moving parts of machinery. The cup is attached to the bearing by a screw neck. The top of the cup is closed by a screw cap, through the center of which passes a spindle having at its lower end a plug valve shaped as shown in the engraving. In the lower end of the neck is a recess, which provides a seat for the valve, and an aperture leads from the recess to an oil chamber formed in the neck immediately under the shoulder of the spindle. A spiral spring acts to lift the spindle and hold the



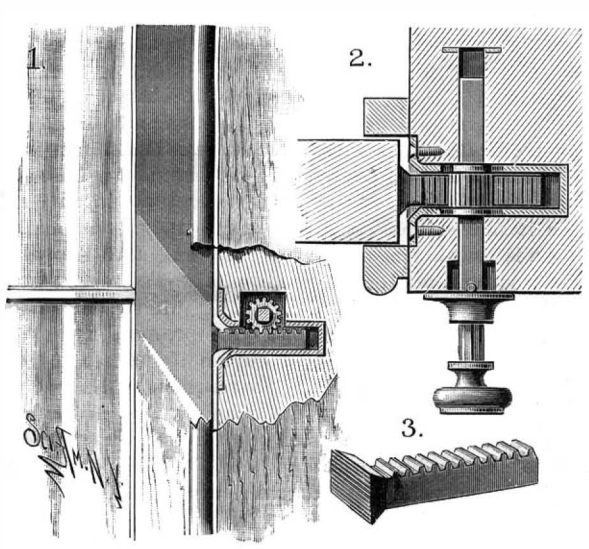
SLANKER'S IMPROVED OIL CUP.

valve to its seat, to prevent escape of oil from the cup. When the spindle is pressed downward, the valve will be lowered and the spindle shoulder will force all the oil from the oil chamber on to the shaft in the bearing. When released, the spindle will be raised by the spring, when the oil will refill the chamber. It will be seen that the size of the oil chamber governs the quantity of oil discharged at each downstroke of the spindle.

This invention has been patented by Mr. F. O. Slanker, of Pomona, Cal.

SASH FASTENER.

This device—the invention of Mr. Richard Gibbon, of Mobeetie, Texas—is for holding a sash at any desired elevation; it is simple in construction, and can be applied to any window. The casing is provided with an end plate and with two side plates; a squared spindle passes freely through lugs on the side plates, and projects from the front side of the window casing, as shown in the sectional plan view, Fig. 2. The spindle also passes through an escutcheon fastened on the casing and having a cogged opening into which a cogged part of the spindle at the knob can be passed. A pin prevents the spindle from being pulled out too far. A bolt, Fig. 3, formed with a rack on its upper edge and with a slightly serrated head on its outer end, is operated by a pinion revolved by the spindle. To hold the sash at any elevation, the spindle is pulled out until the cogged



GIBBON'S SASH FASTENER.

part is withdrawn from the escutcheon, and is then turned in such a direction as to press the bolt head firmly against the edge of the sash. The spindle is then pushed in, when the cogged parts interlock, and the bolt is held in place. The spindle is withdrawn to release the sash. If needed, a small socket can be placed in the sash to receive the bolt when the sash is closed.

OIL stains may be removed from paper by applying pipe clay powdered and mixed with water to the thickness of cream; leave on for four hours.

Plating without Electricity.

A curious phenomenon has been observed by M. Blondlot, and communicated to the French Academy of Sciences. A disk of platinum and a disk of copper, 0·03 meter in diameter, were fixed vertically in front of each other by help of two platinum stands. The disks were three or four millimeters apart, and both were placed inside a bell jar of porcelain, open below. The apparatus was then heated red hot for three hours by means of a gas furnace; and although there was no electric current, it was found that the face of the platinum disk was blackened with a deposit containing copper and platinum. In short, the copper had crossed from the copper plate to the platinum one. M. Blondlot, by repeating the experiment in different gas, found that the nitrogen of the air was the agent in this transport of matter. The nitrogen combines with the copper, and lodges on the platinum, either incorporating itself with the latter or decomposing in contact with it under the influence of its high temperature.

How to Design a Monogram.

Scarcely anything seems so easy as to design a monogram, yet we see very few successful ones, the most of them being a mass of mixed up letters and ornaments of which we can find neither the beginning nor the end. There is a law regulating the designing of everything, and it is this law which the true designer keeps in mind and applies to his work; the effects of obedience to this law, and its violation, are seen as clearly in the design for a monogram as in the design for a cathedral.

First, there should be harmony of composition, that is, the letters should so emphasize, subdue, or control each other that the composition should impress us as compact, appropriate, and, being so, beautiful.

Second, there should be no unnecessary ornamentation; there should be a quiet and peace about the design which will always please the truly artistic. Looking at some designs, we get the impression that ornament was so plentiful that the designer saw no other means of consumption than that of burying his designs in it, for we see that there is a mass of curves, angles, shades, and leaves, but nothing else.

Third, simplicity of lettering is an important requisite, as there should be no possibility of mistaking an E for a G or C, and the boundaries or outlines of the letters should be well defined.

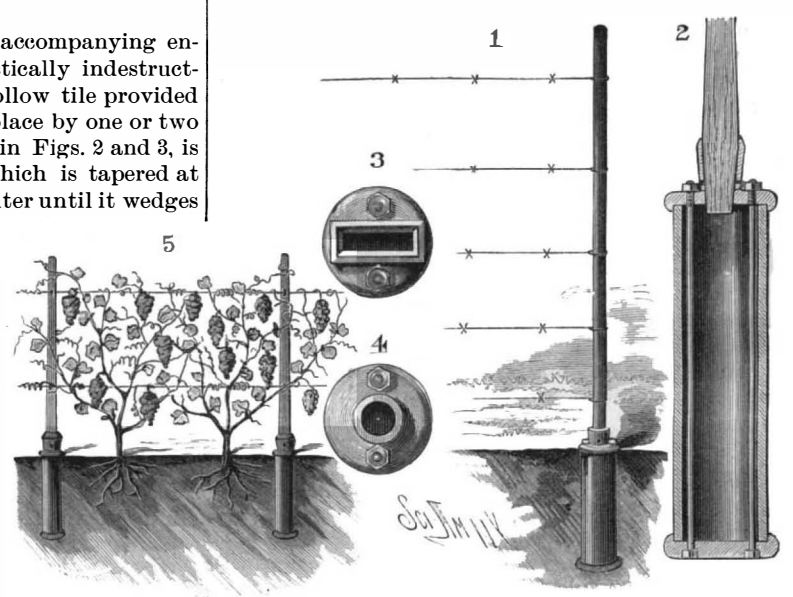
Fourth, the order of sequence of the letters should be carefully attended to.

The common idea is that a certain number of letters are given with which to make a pleasing design, and so far, that impression is right; but there is something beyond this. There is the art of so placing the letters that one can distinguish at a glance the first, the central, and the last letter. Now, the rule to be observed to secure this result is as follows: The last letter of the monogram must be the principal feature, and must be the largest, the boldest, and the heaviest letter; then the first letter must be the next in size, but the lightest in outline and color; then the central letter must be the smallest, and of an intermediate tint. If the monogram is of four letters, the two intermediate must be of the same size, and the second letter lighter in outline and color than the third.—*Art Amateur.*

BASE FOR POSTS.

The base for posts shown in the accompanying engraving is simple, cheap, and practically indestructible. It consists of a section of hollow tile provided with a top and bottom cap held in place by one or two bolts. On the top cap, as shown in Figs. 2 and 3, is formed a cup to receive the stake, which is tapered at its lower end, and is allowed to enter until it wedges sufficiently tight in the cup. The cups are provided with side openings, to facilitate the removal of dirt and to allow rain or snow and ice water to run out. When two bolts are employed, as shown in the cuts, instead of a single central one, the bottom of the cup opens into the tile. With this style of a cup, any available stakes, waste lumber, etc., may be shaped to fit within the cups. When used as a base for a trellis, as shown in Fig. 5, in the fall of the year the posts can be lifted out of the cups and laid on the ground; in the spring they can be easily and quickly set up again. The cup may be formed to receive the end of a piece of ordinary gas pipe, as shown in Figs. 1 and 4. A post constructed in this manner may be used to support barbed or other wire, forming a complete fence, at once indestructible, that will be especially adapted to use in places subject to fires, as in case of railroad fences. The base is easily and cheaply made of fire-clay tile, which is proof against frost and disintegration, and cast iron caps of desirable size and shape.

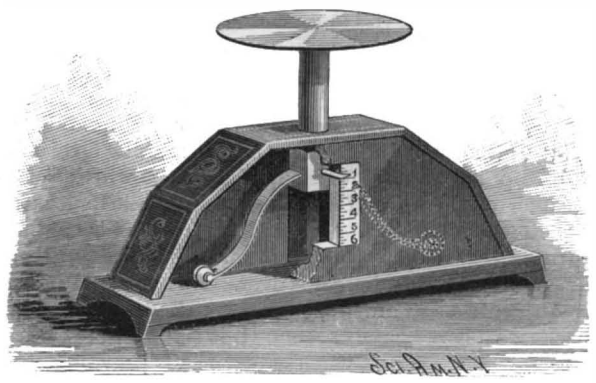
This invention has been patented by Mr. W. H. Kellogg. Further information may be obtained from Mr. W. A. Forbes, of Kalamazoo, Mich.



KELLOGG'S BASE FOR POSTS.

SPRING BALANCE.

The spring balance here shown weighs accurately and is very simple in construction. In the center of the case is a vertically sliding block provided with a pointer projecting through a vertical slot in the front of the casing. At the edge of the slot is a graduated scale. A rod projecting from the block through the top of the casing carries a plate on its upper end for receiving the article to be weighed. Secured to the block is a flat curved or bow spring, at the ends of which are rollers that run on the upper surface of the base. When an object is placed on the pan, it presses the rod downward, and thereby the spring is compressed more or less, its ends separating. The pointer shows the weight of the article. When the



WATT'S SPRING BALANCE.

article is removed, the spring contracts and moves the pan upward until the pointer is at the top of the slot.

This invention has been patented by Mr. William R. Watt, of Somerville, Tenn.

A Curious Chemical Phenomenon.

A celebrated Parisian belle, says the *Popular Science News*, who had acquired the habit of whitewashing herself, so to speak, from the soles of her feet to the roots of her hair, with chemically prepared cosmetics, one day took a medicated bath, and, on emerging from it, she was horrified to find herself as black as an Ethiopian. The transformation was complete; not a vestige of the "supreme Caucasian race" was left. Her physician was sent for in alarm and haste. On his arrival he laughed immoderately and said: "Madame, you are not ill, you are a chemical product. You are no longer a woman, but a 'sulphide.' It is not now a question of medicinal treatment, but a simple chemical reaction. I shall subject you to a bath of sulphuric acid diluted with water. The acid will have the honor of combining with you; it will take up the sulphur, the metal will produce a 'sulphate,' and we shall find as a 'precipitate' a very pretty woman." The good natured physician went through with his reaction, and the belle was restored to her membership with the white race.

Education.

A bill now before Congress aims to set aside the net proceeds of sales of public lands for educational purposes. Besides the actual receipts, this will include all fees received at the General and District Land Offices and three-fourths of the total moneys paid into the Treasury by railroad companies under the act of May 7, 1878. This money will be apportioned, upon the basis of population between the ages of five and twenty years, to the different States and Territories, and is to be set aside as an educational fund, the interest at 4 per cent to be paid as apportioned. For the first ten years the apportionment of the total sum and the interest on the fund is to be made according to the number of the population of the respective States and Territories of ten years old and upward who cannot read or write, as shown by the last census.

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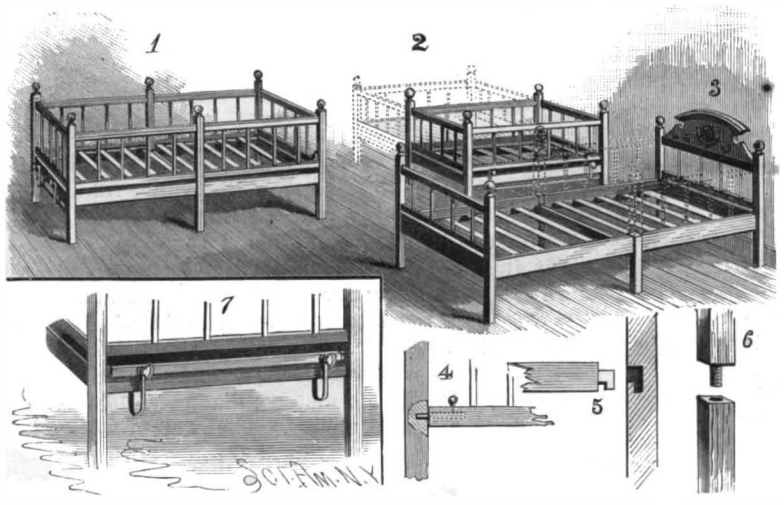
Grips and Brakes for Brooklyn Bridge.

The Committee on Mechanical Appliances have reported to the Bridge Trustees that they have now examined 39 grips, 5 cable lifters, and 26 signal, brake, and grip plans. They have given authority to Mr. George Westinghouse, of Pittsburg, to try his compressed air system on the bridge. He is to bear all the expense of getting up a brake and power to work the present grip, except that the Trustees will make the connections with the cars on the bridge. Mr. Westinghouse is now preparing to fit up a train of four cars with reservoirs of compressed air and the necessary machinery to work the present grips and brakes by one person only, in the same manner as locomotive engineers now control the air brakes on railway trains. Having inspected in all about 113 projects and inventions, the committee have ended their examinations.

AN ADJUSTABLE CRIB AND BEDSTEAD.

The invention herewith illustrated covers a form of adjustable bedstead and crib for children which is simple in construction, but admits of being arranged in several different ways to suit the convenience of a family. Figs. 1 and 3 represent the dimensions of a full-size bed, the former without a head piece, and the latter, as well as Fig. 2, showing in dotted lines its modified forms as a simple or double crib. Fig. 4 shows a simple spring catch by which the end pieces are held perpendicularly in the uprights, and Fig. 5 represents the ordinary manner of holding the side and end pieces in the posts. Fig. 6 illustrates the manner of securing the uprights in the center posts for holding the side pieces and cross divisions, and Fig. 7 represents a cover tucking attachment. The latter may be applied to both sides and ends, and is a variety of goose-necked piece of spring metal, screwed to the bottom side of the cross and end pieces in such way that, by means of thumb screws, a horizontal piece of thin slat is made to firmly bind the cover. In fitting the bed for a double crib, only one mattress and the usual blankets, quilts, etc., are needed, the cross piece being easily raised for adjusting the bedding, and then fitting closely over it, tucking in the children. When the children are too large to use the cribs, the cross piece can be removed from the center part and the bed can be used lengthwise, the sides remaining to form a protection if desired.

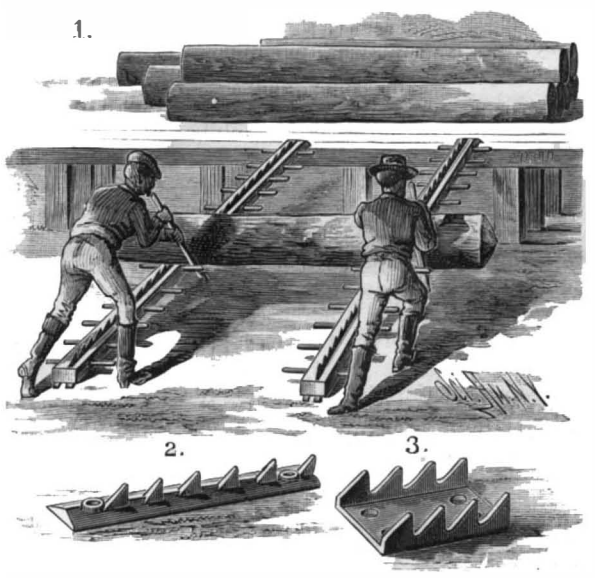


JENKEN'S ADJUSTABLE CRIB AND BEDSTEAD.

This invention has been patented by Mr. C. A. Jenkens, of New Berne, N. C.

SPIKED SKID.

The accompanying engraving represents a skid used for handling logs and heavy timber. The skid is provided with one or more ridges or rows of saw-tooth-like projections upon its upper surface, and with a series of horizontal pins, which serve as fulcrums for the hand spikes by which the logs are moved. The teeth are formed of iron or steel plates, different forms being shown in Figs. 2 and 3. It is apparent that these teeth prevent the logs from slipping or rolling backward. By the use of these skids, heavy logs can be easily moved from one level to a higher. The log cannot slip back, and not only are time and labor thereby economized, but the workman is given a chance to rest whenever necessary.



POLLEYS' SPIKED SKID.

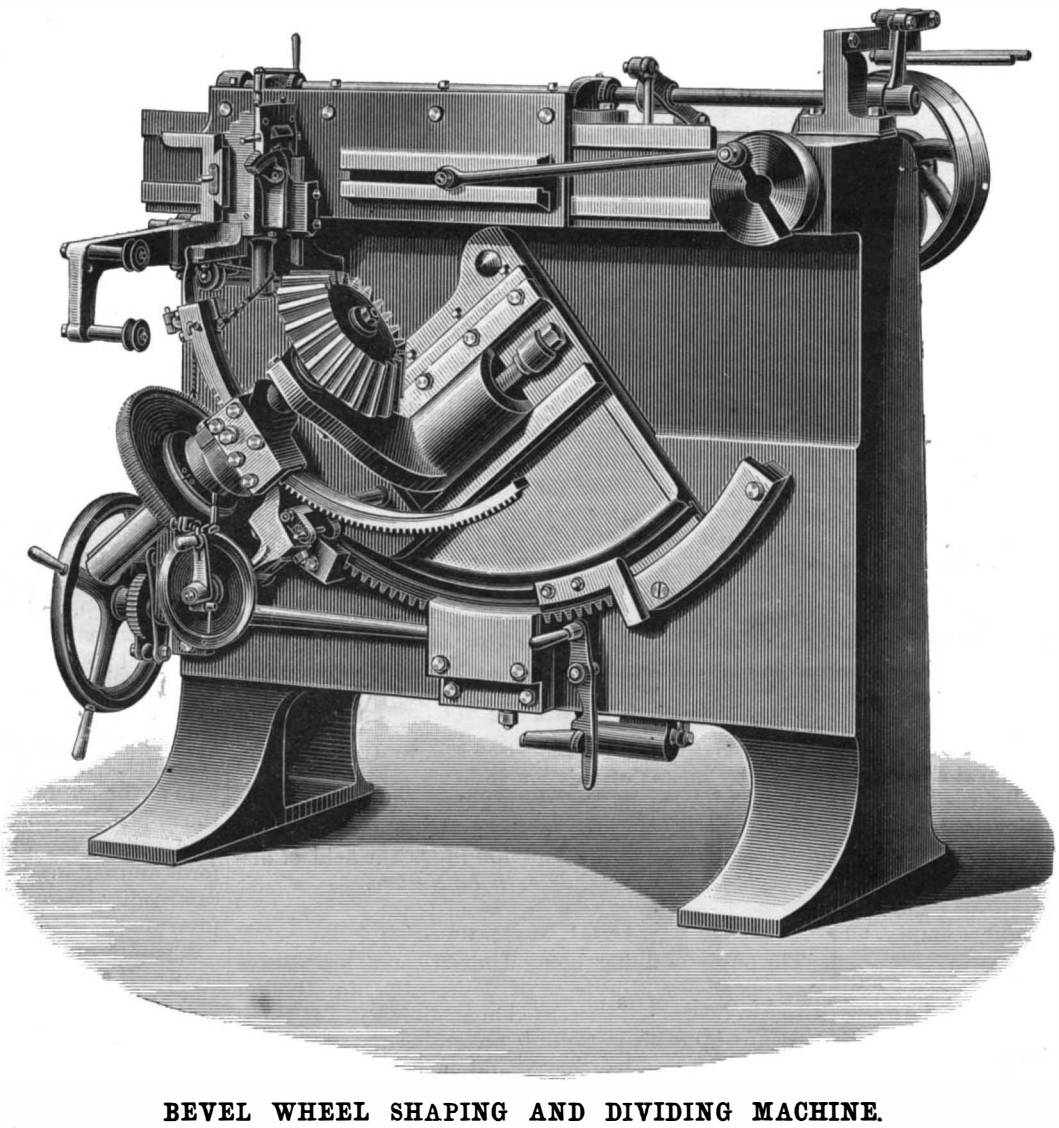
This invention has been patented by Mr. William H. Polleys, of Neillsville, Wis.

Progress of the Statue of Liberty.

The pedestal for Bartholdi's great statue has now been completed. The last piece of stone has been put in place, and the last of the large iron girders to which the statue will be fastened is ready for duty. When completed, the statue will look even grander at night than in the daytime, as its electric illumination will give the figure greater prominence. It is proposed to place four large lights at the base of the statue, one at each corner of the pedestal, and a powerful shaft light on the torch, so arranged that its beams will shoot high into the heavens. The lights at the base will be so placed as to illuminate the statue and bring the figure into bold relief on the darkest night. The light of the torch will be 300 feet above water, and should be visible for about twenty-five miles at sea.

BEVEL WHEEL SHAPING AND DIVIDING MACHINE.

We illustrate a bevel wheel shaping and dividing machine to cut wheels up to 18 inches in diameter, constructed by Greenwood & Batley, of Leeds, and described in *Engineering*. It is designed to shape the teeth under the guidance of a copy or former, four or five times the size of the desired tooth. The tool is held in a box carried by a reciprocating slide, like the slide of a shaping machine, and has a stroke of about 5 inches. The wheel or bank is mounted on a spindle, the nose of which is covered, and fitted with a steel mandrel to receive it. The spindle is carried on two bearings, of which the upper can be moved in a slide by a screw to adjust the wheel. The other bearing is a long socket, and is itself carried by a bearing on a segmental plate capable of rotation about a point toward which the cutting edge of the tool always travels. The spindle can be moved endwise by the upper bearing to set the blank in the first instance, and can be rotated by a worm and wheel on the lower socket. Attached to this same socket is a curved radial lever, carrying at its extreme end the copy or former, which is kept in contact with a steel guide plate by means of a weight having a cord passing over guide pulleys. The spindle and all its adjustments are carried on the segmental plate, and can be moved by means of a worm and toothed sector to feed the blank toward the tool. This latter travels always in the same straight line toward the apex of the imaginary pitch cone of the wheel, and has no feed motion. The blank is moved in two directions; it is raised toward the tool by the rotation of the sector, and at the same time it is rotated on its axis through a very small angle by the "former" sliding over the guide plate. The cutting pressure of the tool tends to hold the "former" and the plate together. When the tool has reached the bottom of the tooth, the catch motion shown at the lower part of the machine comes into play, and throws off the strap. The attendant then winds back the toothed sector, rotates the blank through the required angle, and sets the machine in action again.



BEVEL WHEEL SHAPING AND DIVIDING MACHINE.

Long Distance Gas Transportation.

In a paper upon the long distance transportation of natural gas, Mr. Thos. P. Roberts has expounded, before the members of the Engineers' Society of Western Pennsylvania, certain views which may be briefly summarized as the advocacy of exhaustion instead of forcing as the means of propelling gas through mains. The author depends greatly upon the example of English mine ventilation, by which in some cases a furnace, and in others a fan, draws a current of air through perhaps 40 miles of workings. He refers to the formulæ given in text-books concerning the delivery of air and gases under pressure, to show that friction is always provided for; so that when forcing any expansive fluid has to be resorted to, there is a limit to the length of the circulating system (which may be ascertained by computation) beyond which the fluid will not flow. On the principle of exhaustion, however (which means the progressive reduction of density of the contents of a pipe as it is prolonged from its inlet to the outlet where the exhausting apparatus is situated), Mr. Roberts declares he knows of nothing to stop the onward course of a gas when it has "an inclosed passage continually opening before it." On the other hand, he states that at a certain rolling mill several years ago, the 6 inch gas main proved insufficient for the required supply. Pumping at the supply end was resorted to, and several attempts resulted in failure. Finally, a special Cameron pump made for the purpose was tried. This pump had a 40 inch plunger and 4 feet stroke. It took the gas at the supply end at 30 pounds pressure; and, although in desperation the pump was driven at 250 revolutions per minute, the gas at the delivery end never rose above 15 pounds pressure—thus losing half the pressure in transit, notwithstanding the great compression at the inlet end. Mr. Roberts was unable to say whether the engineers "changed ends" with their pump, and if so, with what results.

To prevent a strong solution of potash from crystallizing, dilute by the addition of water.

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Industrial Education.

An exhibition has recently been held in New York city, under the auspices of the Industrial Education Association, which has brought the subject of the manual training of young people more prominently before public attention than any amount of pamphlet literature could possibly have done, for by showing what the children have already accomplished, the possibilities of the future are conclusively demonstrated.

The exhibit was made up of individual contributions and of collections sent from the different industrial schools throughout the country. They included every department of labor—drawing, modeling, wood and metal working, repousse and leather work, printing, embroidery, sewing, and even plain cooking. Competition for the prizes was limited to pupils under fifteen years of age and to those living within twenty miles of New York. Many of the most complete educational exhibits, however, came from cities at some distance, those from the industrial schools of Philadelphia, Chicago, Worcester, St. Louis, New Haven, and Cleveland being particularly attractive. They illustrated the different steps in manual education, and showed a thorough systematizing that promises the most gratifying results for the future. The New York public schools were not very well represented, but the exhibits from many of the private institutions were worthy of thoughtful study. This was particularly the case in the display of mechanical and engineering models.

Few men of the present untrained generation could compete with these boys of fifteen years and under, in the accuracy and finish of their work. The Gramercy Park Industrial School exhibited a very fine model of a suspension bridge, made from full sized drawings at a scale of one-sixteenth of an inch to the foot. This was the work of seven boys, all under fifteen, and secured the first prize. A very perfect little model of a stone-cutting machine, made by one of the pupils of the Amateur Technical Union, and designed to show the manner of dressing marble, sandstone, and other of the softer building stones, was awarded the second prize in this department. The exhibits of the Hebrew Technical Institute and the Yonkers public schools also contained much that was ingenious in the way of models and mechanical toys. The exhibition was open for a week, and was witnessed by at least 7,000 persons. The bulk of the unsold contributions has been transferred to the training school of the Industrial Association, and will form the nucleus of a permanent exhibition. Arrangements have already been made for similar exhibitions in several neighboring cities. It is confidently believed that this movement for the manual training of American citizens, which has pushed its way in the face of so much opposition and indifference, is now established on a firm foundation, and by making industrial education a recognized feature in our public school system, will give us a generation of skilled native workmen.

Useful Hints for Horse Owners.

Horses are very delicate and liable to many ailments, and persons owning them, who are not very familiar with their nature and requirements, will find the following suggestions, condensed from an article in the Cincinnati *Enquirer*, useful:

Never feed a horse with hay from a rack located above his head, as a draught beats down which is injurious, and the dust is liable to injure the eyes.

A horse should not be overworked, for, like man, he gets tired, and to keep in good condition, he should have rest and good bedding.

Sometimes a horse will not eat his usual food. A mash of oatmeal, milk warm, is about the best food to give a horse under such circumstances. And then a horse should have grass. It is his natural food. A continual diet of hay hardens the coating of his stomach. The food is not digested. Carbonic acid gas is generated, and the horse dies in agony, swelling up, suffering from what is commonly known as colic. Then, again, horses need well ventilated stables, free from draught or damp. The floor should be smooth and nearly level. It should be well drained and light, for sudden change from darkness to light is trying to the eyes, and a damp, offensive odor is injurious. Then, again, the bedding and litter should be carefully separated from that which is foul. They should be well shaken up and dried, and the stall should be thoroughly cleansed; and when the stable is empty, let in a plenty of fresh air.

A horse's stall should be large enough to allow him to lie down comfortably in any position. A tired horse will be glad to lie down with his legs stretched out if he has room; but if you can't give him a loose box, then a light halter block should be used, and care taken to arrange the halter so that it may travel freely to allow the head to come easily to the litter, for rest and sleep are as necessary as food and water.

If a horse comes to the stable wet, he should be rubbed dry before the blanket is put on. If he is standing about in the cold, it should be put on. The legs should be rubbed, and the hoofs always examined for stones.

SMOKE CONDENSED BY MEANS OF ELECTRICITY.

(*Continued from first page.*)

The experiments of Mr. Lodge are of that class which will in time become classical, and which should be made public. It was with this object that the two devices illustrated (Figs. 1 and 2) were constructed. The larger apparatus is designed to show the effect of electricity upon smoke in motion (Fig. 1). It is provided with a furnace, in which may be burned the materials for producing the smoke. The fumes first pass into a box having glass sides, which enable us to see what is going on inside. This is connected with another box of the same kind by means of a horizontal glass tube. The second box has a tube at its top and a device for regulating the draught. Each of the boxes in its opposite sides is provided with brass combs, which are connected with the opposite poles of a Toepler-Voss, a Ramsden, or Holtz electrical machine.

German tinder, for instance, is put into the furnace. The thick smoke which it produces passes through the whole apparatus. If the electrical machine is now put in motion until the sparks pass between the combs, immediately the smoke becomes agitated, and in a little while will disappear by condensation. The boxes and tube become as transparent as before the experiment.

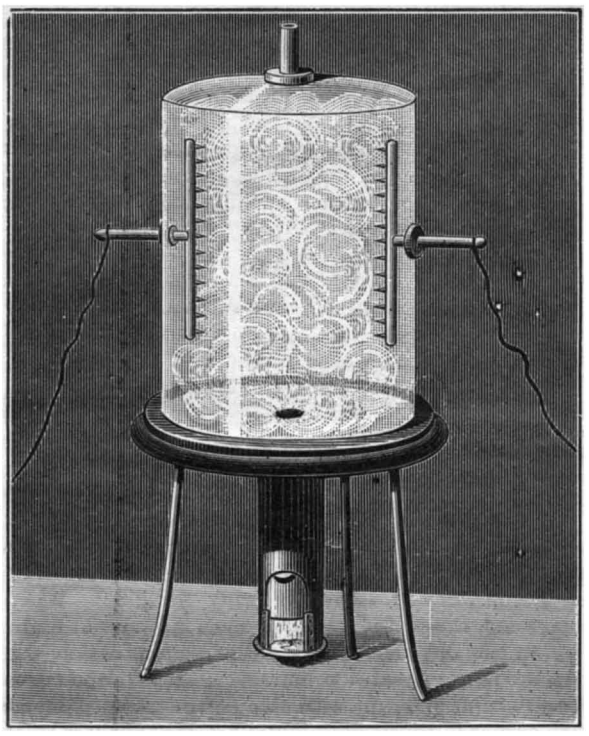

Fig. 2.—SMALL APPARATUS FOR CONDENSING SMOKE BY ELECTRICITY.

The smoke of German tinder can be advantageously replaced by that which is produced by the combination of hydrochloric acid and ammonia. The white thick smoke of hydrochlorate of ammonia condenses very rapidly on the electrified combs.

The smaller apparatus (Fig. 2) is much more practicable for experiment. It shows the effect of electricity on smoke at rest, and gives a clear idea of the phenomenon.

It consists in a glass cylinder having openings in its side, through which are passed the metallic combs. It is mounted on three feet, and is provided with the furnace for producing the smoke. The draught is maintained through the tube in the top of the chamber. Paper treated with niter or German tinder is burned in the furnace, or else the vapors upon which the experiment is to be made are liberated by some chemical reaction. When the glass cylinder is full of smoke, the machine connected with the combs is put in motion, and the vase, smoky and cloudy, immediately becomes clear and transparent, the vapors being condensed.

Tobacco smoke is very quickly and easily condensed by means of this machine.

These phenomena are remarkable. They appeal at once to the savant, the artisan, the student of hygiene, and demonstrate how infinite is the field of discovery.—*Gaston Tissandier, in La Nature.*

Aerial Navigation.

The power of flying, being denied to man, has always been one of the objects most desired by him, though hitherto he has not succeeded in attaining it. If there were any large birds feeding on grains and possessing strong flying powers, they would no doubt have been domesticated long since, and made subservient to man's use, like horses and other animals. But, unfortunately, all large birds possessing strong wing power are carnivorous and untamable, so we shall have to rest content with terrestrial locomotion till we have succeeded in solving the mechanical problem of propelling and steering balloons. We are still a long distance from this result, and it is at least very doubtful whether it will ever be attained.

The difficulty lies in the small specific gravity or density of the air, which demands on the one hand very large vessels, and consequently large surfaces, in order to obtain sufficient buoyancy to lift even small weights, while on the other hand it affords only a slight resistance to the propelling mechanism. A submerged torpedo boat has a cross section which is in a moderate ratio to the area of the propeller, but in a balloon the cross section on which the air acts is enormously large in proportion to the area of any propeller which can be applied. Even ships have difficulty in moving against currents, although only submerged to a small extent, but in balloons the difficulty becomes so great that we are afraid it will not be overcome until we have discovered a material combining the strength of steel with the specific weight of air.

The partial success which attended the trial of the Krebs-Renard balloon, which ascended at Meudon in August, 1884, and proved navigable in a quiescent atmosphere, but failed completely when there was a little wind, seems to have stimulated the other votaries of aeronautics. We hear from Berlin that another dirigible balloon is being constructed there by M. Ganswindt, its inventor. The object is to secure, by means of great size, capacity for carrying power and a swiftness exceeding the strongest wind, so that the balloon shall remain steerable. The speed the balloon is expected to attain is 45 to 50 feet per second. Its dimensions are: Length, 150 meters; diameter, 15 meters; contents, 18,000 cubic meters. The weight will be 430 cwt. It is stated, says the *Mechanical World*, from which the above is copied, that the inventor has already received an offer of £10,000 for his patent, and the editor adds, "which we should certainly accept if we were in his place, as after trying the balloon we should be afraid not to receive any further offers."

Rare Metals.

The necessity for minute accuracy in chemical analysis has just been illustrated in an important discovery by Dr. Strohecker, of Frankfort. Somewhat extensive diluvial deposits of brick clay exist at Hainstadt, near Seeligenstadt. The bricks made from this clay vary considerably in color, according to the temperature at which they are burnt, but the cause of the variation has never before been suspected. It now appears that the layers of this clay are singularly rich in several metals hitherto very scarce, particularly cerium, glucinum, lanthanum, didymium, and yttrium. The first two of these metals are present in such quantities that a more abundant supply may be expected. Ceria, in the form of hydrate, constituted 9·4 and 13·4 per cent of the clay in two layers analyzed, and the color of the bricks seems to be mainly determined by its presence, for the quantity of iron present was very small. The discovery is therefore of immediate value, and will doubtless lead to further researches on the elements, which may prove to have much more importance in the economy of nature than has been supposed. It is evident that we must not neglect these little known elements, for, apart from their scientific interest, we cannot tell what undiscovered uses may lie in them. We do not know, indeed, whether they are really as scarce as has been supposed.

COMBINED TRUSS AND SUPPORTER.

The principal feature of the improvement herewith illustrated is the combination of an abdominal supporter with a rupture pad acting independently of the abdominal supporter and having a decidedly inward and upward pressure. Thus the abdominal supporter relieves the ruptured parts from all undue pressure arising from the weight of the abdomen, and the rupture pad has only to hold the small portion of the intestines affected by the rupture, for which a very light pressure by the pad is sufficient. Another feature of the improvement is the application to the pad of a coil spring which affords an easy inward and upward pressure, and which can readily be exchanged for one of lighter or stronger pressure.

SHULZ'S COMBINED TRUSS AND SUPPORTER.

A patent for this invention has recently been issued to Mr. Henry A. Shulz, of Brooklyn, N. Y. Further particulars will be furnished by the Smith Truss Company, 25 Temple Court Building, New York city.

Detection of Minute Traces of Color.

Interesting experiments have been made by E. L. Nichols on the quantity of coloring matter which must be mixed with a perfectly white powder (carbonate of magnesia) before the human eye can detect it. From these experiments it appears that red and yellow are most easily detected, 16 and 17 parts respectively being sufficient for detection when mixed with one hundred million parts of white powder.

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Correspondence.

The Propulsion of Electric Pendula.

To the Editor of the Scientific American:

On page 107 of the SCIENTIFIC AMERICAN, for February 13, a query is asked by C. A. Y. as to the number of cells of a "gravity" battery necessary to propel a ten pound pendulum, beating seconds. The reply to his question tells C. A. Y. that two or three such cells will be requisite.

Let me say to this querist, and all who are interested in electric time, that if they wish to get "time" out of a pendulum kept moving by electricity (or any motor), the force imparted to the pendulum must be a minimum—just enough to keep up the "swing," and no more; in other words, the pendulum must be left as absolutely free from all interference as possible, as can easily be seen to be necessary by looking at the mathematical theory of pendula.

The amount of power necessary to keep up the vibration is very much less than the answerer of C. A. Y.'s query evidently has any idea of, being (in the case of the great clock at the Houses of Parliament, at Westminster) only 1 ounce falling nine-tenths of an inch at each beat (or every 4 seconds), and is ample to drive a pendulum weighing 700 pounds, or, say, 200 foot pounds per diem! From these data, C. A. Y. will see how very minute is the force required to keep his 10 pound pendulum in motion. I should say, one gravity cell ought to be ample indeed.

N. B. SIZER, B.Sc., M.D.

Brooklyn, N. Y., February 12, 1886.

[The two or three gravity cells mentioned by us are good practice, and are what are in daily use in this city in the case of such a clock as described. Where continuous action and reliability is looked for, it is well to have battery force above the theoretical requirements. One great source of resistance to the motion of a pendulum is due to the air, and this is much greater in small than in large pendulums, in proportion to their weights. The ratio of air resistances in these two cases would not be far from one to sixteen, allowing for the pendulum rod, etc.—ED.]

Manufacture of Crystal Balls.

To the Editor of the Scientific American:

It has been generally conceded, by the few owners of the beautiful spheres of rock crystal (quartz) which are now considered the acme of a Japanese bric-a-brac cabinet, that they could only be manufactured in Japan; no other people having the patience and the requisite skill to fashion a mass of rock into such a perfect shape.

This opinion prevailing among collectors of *chef d'œuvres* has been the sole reason for the astonishing prices which crystal balls have occasionally brought. Only lately, at the sale of Mrs. Morgan's collection of Oriental curios, a perfect sphere of transparent colorless quartz, four and one-half inches in diameter, brought the sum of seventeen hundred and twenty-five dollars. The writer also remembers the sale of a ball of about the same size, in 1877, for two thousand dollars. An extraordinary one, in point of size, being nearly seven inches in diameter and quite perfect, is held by its owner at a valuation of five thousand dollars. Now, such prices and valuations are founded only upon the mistaken idea of the rare skill and great patience thought to be *necessary* to shape such objects to such perfect results.

A halo of mystery surrounds these objects of Oriental workmanship, too, and helps to give absurd ideas of value to them.

The word "Oriental" is also pushed to extreme uses by the dealers in Japanese bric-a-brac, as, for instance, a dealer possessing a crystal ball will confidently assure you that rock crystal from the Orient (India, China, or Japan) is very much *harder* than the same material from other regions; which assertion has no foundation in fact.

The hardness of quartz *is an essential constant* of the mineral, as are also the elements of its crystalline form. Wherever found, quartz crystals are identified by their uniform hardness, density, and shape.

Appreciating the several facts above mentioned, the writer saw no reason why America could not produce these crystal spheres equally as beautiful as the famous Japanese productions; and with this end in view, he first sought the *material* suitable for the purpose, being confident that the labor of shaping and polishing was but a secondary matter, a mere mechanical operation.

As early as 1878 my attention was directed to the Southern States, as a probable region wherein to procure clear crystal masses for art purposes. It was in 1879 that I had my first success in discovering a locality of really fine and perfect material. This was in Sharpe's township, Alexander Co., N. C. Since then, I have found occasionally very creditable masses in other parts of North Carolina, and also in Virginia, South Carolina, and Georgia, though in none of these places in any great abundance. California and Arkansas have furnished great quantities of clear rock crystal; but perfect pieces of large sizes were very exceptional.

Opportunity for trying the experiment did not occur until the summer of 1884. I then enlisted the services of a skilled lapidary, putting into his hands a piece of clear material from North Carolina, suitable for cutting a small sphere, and urging him to lose no time in completing the work. I was somewhat surprised and pleased to receive from the lapidary the finished ball *within a week* from the time the rough mass was put into his hands, the ball being perfect in every particular of roundness, polish, and pelludicity. It measured two inches in diameter, and possessed every perfection and attractionbelonging to a Japanese crystal ball.

This perfect sphere of quartz, the largest ever cut in America at the time, was exhibited at the North Carolina State Exposition of 1884 and at the New Orleans Industrial Exposition of 1884–85, at which places it received many encomiums from the press, as evidencing the resources of our country and the skill of American labor.

This article is particularly called forth by the completion, on April 3 of this year, after ten days' labor, of a superb crystal sphere measuring three and one-sixteenth inches in diameter, and weighing exactly one and one-half pounds. As a piece of American workmanship in crystal it stands alone, at this time; and in its various perfections is unexcelled, excepting in size, by any similar Japanese effort that has come under the writer's notice.

Therefore, possessing the requisite material, we can henceforth make crystal spheres, lenses, or even "bottles of stone," *here within the United States*, if the *dilettanti* should require them, or fashion demand such articles of luxury. WM. EARL HIDDEN.

Newark, N. J., April 5, 1886.

Early History of the Power Loom.

Some notes on this subject have lately been contributed to a Scotch provincial paper by a retired power loom tenter, who was engaged in working among looms in the Glasgow district for the long period of forty-eight years. When and where power looms first came into existence is, he says, a matter which is not much known at home, and far less abroad; and the statements which he makes he knows to be facts in connection with the matter in question. The following is a condensed chapter of his early history of the power loom:

In the year 1793, a man named Andrew Kinloch, a mechanic, with the assistance of an old clockmaker, made in his little workshop, in a close in the Gallow Gate of Glasgow, the first two power looms that were ever made in the world. The cash for carrying on the experiment was supplied by two enterprising members of the Glasgow Chamber of Commerce. The motion was imparted to the looms through a common crank, just the same as that of a mangle; and after fifty yards of good cloth had been wrought, the experiment was pronounced to be a complete success.

Kinloch at once got an order to make forty looms on the same principle; and in a short time the forty-two looms were set a-going at Milton, near Dumbarton, by water power. The management of the little factory was placed in the hands of Kinloch, who taught two young lads the art of tenting the looms. One of them was Walter M'Cutcheon, who in later times was for many years manager of the Wellington Factory, Hutchestown, Glasgow, and the other was Archibald Barclay, who held a similar position at Catrine Works, Ayrshire. These two men were the first who ever handled a screw key as power loom tenters in this or any other country. The walls of the little old factory at Milton are standing at the present day, but completely enveloped in a mantle of ivy.

Our historian lately accepted from Mr. Muter, the present proprietor of Milton, an invitation to visit and inspect the ruins of this first power loom factory, which greatly interested him. The old wheelhouse lade, which contained a wheel 33 feet in diameter to provide driving power for driving the looms, is still in existence. Mr. Muter told him that his uncle, the late Patrick Mitchell, who was the previous proprietor of Milton, preserved two of the original looms, which were kept as relics, and that he had intended sending them to the Great Exhibition of all Nations held in London in 1851, but unfortunately the storeroom in which they were kept was destroyed by fire one night, and the looms were burnt to ashes.

After the little factory had wrought for twenty years, but before machines for dressing weavers' webs had been invented, it was found that the looms were not profitable, and they were put out in the year 1813. A Paisley firm purchased the forty looms and set them a-going in the old Abbey Close Mill, where they were worked by steam power for many years. Shortly after the looms were put out of the little factory at Milton and removed to Paisley, yarn-dressing machines were brought into successful use in Glasgow, and by this means power loom weaving was made a very profitable line of business, which was evidenced by the fact that in a very few years many thousands of power looms were started in Scotland and England.

In the year 1842 our historian was working in the Wellington Factory, Glasgow, where Walter M'Cutcheon was the manager, and at that time old Kinloch, whose hair had become as white as the driven snow, paid a visit to Glasgow. As soon as it was known who he was, the managers, tenters, and yarn dressers in the numerous power loom factories that had by this time been established in Glasgow and suburbs rallied around him, and after proper arrangements had been made for the occasion, the veteran inventor was entertained to supper by them, and presented with a purse of sixty sovereigns, in consideration of his being the inventor of the power loom. As our historian was one of the subscribers to Kinloch's token of respect, he was present at the festive meeting and heard the venerable inventor relate the history of his early power looms. Kinloch informed his audience that he had met with no opposition in Glasgow, but when he visited England he had a very different reception. After he had got a hundred looms started in a little mill at Staleybridge, a great mob, which consisted chiefly of hand loom weavers, who very naturally considered that the introduction of the new kind of looms would ruin their trade, attacked the factory one dark night and had it burned to the ground. But it was rebuilt on a larger scale in a very short time. Kinloch subsequently went to Manchester, and had great numbers of his looms set a-going there; and in a short time weaving factories started up in many towns and villages in England. The old man went on to say that after he had been informed by a few trusted friends that the hand loom weavers were really bent on taking away his life at the first opportunity, he at once left England for America, where he was well received by all classes, and met with no opposition of any kind in getting his looms started in several parts of the United States. In a few years afterward numbers of power loom factories were started in various parts of the Continent, especially in France, Germany, Belgium, and Switzerland.

The Cheap Dinner Movement.

The movement for supplying wholesome food and dinners to the people at a cheap rate has received a further development from an able and interesting paper lately read by Captain Wolff at the Parkes Museum of Hygiene. The audience, consisting of the Fellows and Members of the Sanitary Institute, and presided over by Dr. Richardson, listened with great interest to the essay, and carried out afterward a very useful discussion. Captain Wolff, who has personally traversed the greater part of the metropolis in order to determine where the wants of the people are most pressing, displayed the results on what may be called a food map of the metropolis. In some of the quarters thus delineated it may truly be said that there is not only deficiency of provisions at a moderate cost, but that the means for the preparation of food of any kind in a wholesome form are completely absent. There are neither kitchens, nor fires, nor cooks. In the wildest parts of the world it would be possible to find better provision than here in the midst of civilization; and how can it be expected that men under such conditions should live a law-abiding, civilized existence? If a man drinks beer, he thinks beer, said Samuel Johnson; and equally true is it that, if a man is forced to feed as wolves feed, he will grow wolfish and out of the ordinary rules of human government, however wisely those rules may have been framed for the common good. The design now suggested proposes to meet the dangers and the difficulties incident and consequent on starved revolt by sensible prevention of danger. It asks for no charity, which, as the chairman insisted, cannot be a permanent aid; but it opens to all thoughtful persons a mode of applying their time and their money in a way that shall yield a return for both, and confer a national service, which it were well to render while times are still peaceful and the masses loyal. The subject is not technically one which concerns the profession of medicine more than other professions or callings, yet we are glad to see that medicine is taking the lead in the practical working of it. If Dr. Richardson and those who are striving with him can but succeed in establishing half a dozen kitchens on a model scale, the success will, we seriously believe, be quickly assured. The movement would rapidly grow, and in a few months the metropolis, in every part of it, would have comfortable dining quarters at which the poorest would be fed wholesomely, rationally, and comfortably. A public kitchen and dining room in rivalry to every public house would be the grandest counterblast to public intemperance that was ever set up.—*London Lancet.*

Disinfection of Rooms.

The author recommends mercuric chloride. The windows, chimney, etc., are carefully closed up, and 50 grms. mercuric chloride are placed in any suitable vessel, which is then set on a pan of burning charcoal, the operator immediately leaving the room and closing the door. After about four hours he re-enters, with a cloth over his mouth and nose, and throws open the windows. After some hours of ventilation a slight stoving with sulphur is made to follow, which neutralizes any remnants of mercury. This process not merely disinfects, but destroys all kinds of vermin.—*M. Koenig.*

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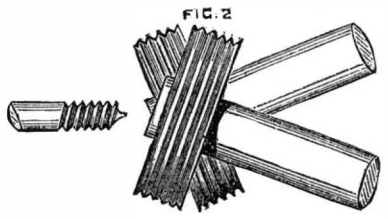
SCREW FORGING MACHINE.

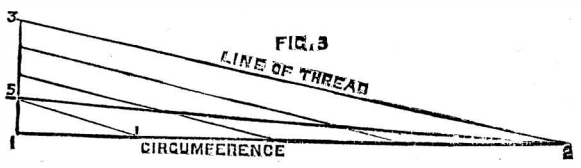
The accompanying engraving illustrates a very ingenious machine for rolling or forging wrought iron and steel screws, designed by Fairbairn & Wells, of Manchester, and described in a recent number of the *Engineer*. Several years have been occupied in perfecting the machines and the process of rolling large screws

FIG. 2



hot and small screws cold, and several of them have now been at work for about nine months in the works of the New Russia Company, of Queen Victoria Street. The machine we illustrate is for making large screws, and is fitted with three rollers, the screws being rolled

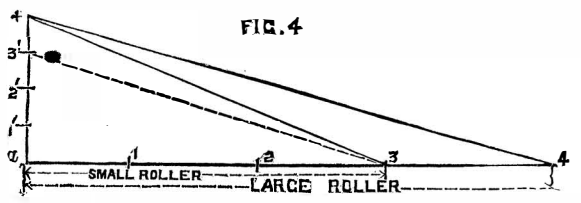
FIG. 3



hot. Screws below ½ in. in diameter are made with four rollers, and are rolled cold.

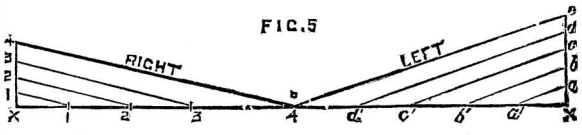
The advantages of screw rolling as compared with screw cutting, for very many of the purposes to which they are applied, are sufficient to make an effective

FIG. 4



machine of great importance. The material which is wasted in cutting a screw in the ordinary way is utilized, and the screw blanks may be considerably shorter in consequence, effecting a saving in some screws—

FIG. 5



such as coach screws—of over 30 per cent. The threads are, moreover, much stronger when rolled than when cut out. The engravings we publish of the sections of screws are facsimiles of screws rolled by these machines, all of which are perfectly made.

For the manufacture of screws by rolling, the machines employed may be divided into two kinds. The first kind has usually three rollers of equal diameter, revolving in the same direction and at the same speed. Grooves are cut in the peripheries of the rollers, of the same pitch and angle as the threads on the bolt blanks to be screwed. The rollers are placed in the form of a trigon parallel to one another, and while revolving are made to open to receive the bolt blank, and then close on it under great pressure. The blank revolving between the rollers receives from the grooves the impression of a thread; but as it simply revolves without longitudinal motion, the thread is raised half its depth above the size of the iron, and the other half sunk into the body of the bolt. Any inequality in the sizes of iron from which the blanks are made makes a corresponding difference in the screws. This machine is, therefore, useless as regards accuracy in fitting nuts.

The second class of machine is entirely different. It can have only two rollers, with plain, straight grooves cut on the peripheries. The axes of the rollers are then set in the machine to give a twist to the rollers, which brings the straight grooves to the angle of thread desired, as indicated in Fig. 2. The blank revolving between the rollers receives the impression of the thread, but for every revolution it makes on its axis it moves out or in one thread, or rather the distance between two threads. This machine also raises the thread, so that it is larger than the blank, a result of insufficient rolling or work. Thus, in making a 1 in. screw with eight threads per inch, and say 2 in. long, the blank would only make sixteen revolutions.

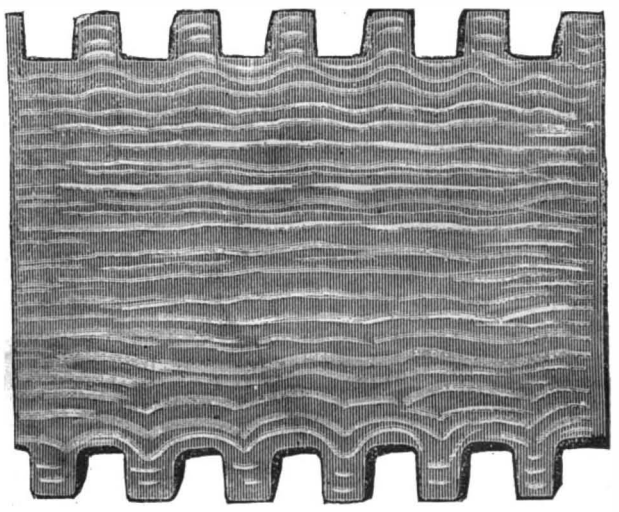
The first machine made by Messrs. Fairbairn & Wells had two plates grooved and sliding in opposite directions, the blank being pressed between them. It was, however, soon found that a screw made between two surfaces while hot is very liable to become hollow or spongy in the center. After a great many experiments three rollers were adopted, but for the purpose of explanation we must describe the machine with two rollers.

If, instead of plain concentric grooves, as shown at Fig. 2, grooves in the rollers are cut to one-half the true angle, or angle of the screw thread, the angle or twist of the rollers must then be reduced, as where the angle of the grooves is increased a corresponding reduction in the angle or twist of the axes of the rollers must be made. For instance, if we suppose the angle of Whitworth threads is 12 deg., and it is desired to give the blank, say, eight revolutions in moving between two threads, then Mr. Fairbairn makes the angle of the grooves on the roller, say, 10·5 deg., and sets the roller's axes to an angle of 1·5 deg.—*i. e.*, 10·5 + 1·5 = 12 deg. In order to produce a right-hand screw, the rollers are cut left-handed. The method used by Mr. Fairbairn is thus described by him: "Suppose a set of rollers is used 4 in. in diameter and, say, ¼ in. in pitch of thread, on 1 in. coach screw, then $\frac{4\text{ in.}}{1\text{ in.}} = 4$ revolutions of iron for one of rollers, and $4 \times \frac{1}{4}$ in. = 1 in., total and true pitch for cutting grooves on rollers. But we want the screw blank to make four revolutions while moving between two threads. Fig. 3 is a diagram of the true pitch with four threads, and axes parallel. Then the line 2–5 becomes the basis, and instead of four threads we get three, and the total pitch becomes ¾ in. instead of 1 in., the other ¼ in. being supplied from the twist of rollers. Generally, the less the twist of rollers, the less the longitudinal motion and better finish given to the screws.

The principal objection to this machine is that the rollers are necessarily small, and so, when making from 4,000 to 5,000 screws per day, one after another, the wear and tear must be great.

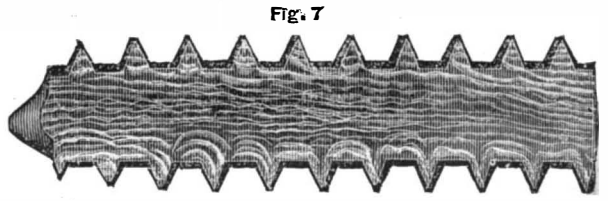
The size adopted for the rollers is six times the smallest diameter of the screw at the bottom of thread. Thus, for ⅝ in. coach screw, the largest possible size would be: diameter of screw at bottom of thread $\frac{5}{16}$ in. full, and $\frac{5}{16}$ in. $\times 6 = \frac{30}{16} = 1\frac{7}{8}$ in., diameter of roller. This is small, although a set of 3 in. rollers has been working eighteen months without change.

Fig. 6

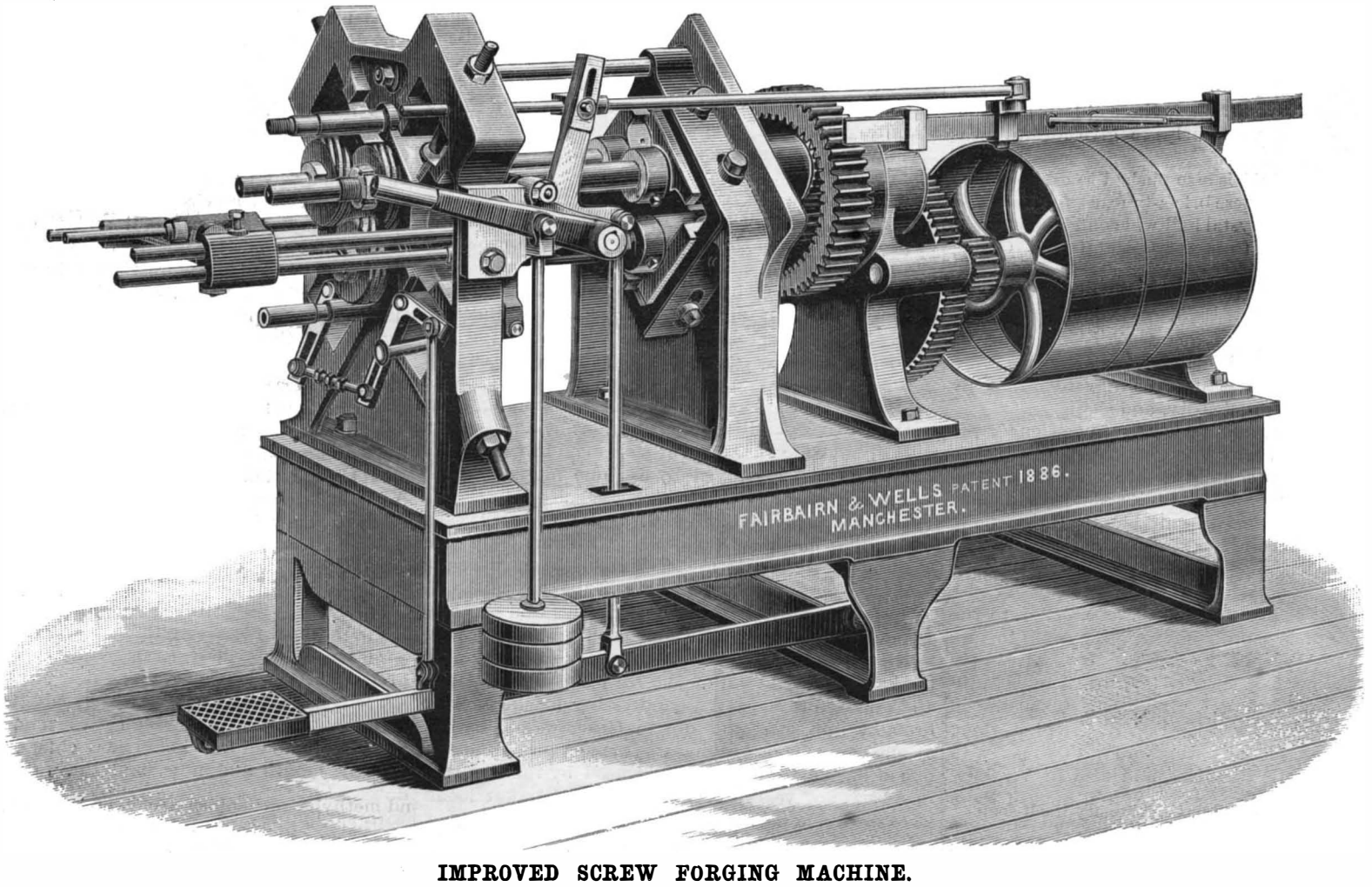


To obviate these disadvantages, the four-roller machine has been made, in which larger rollers for any purpose and of one size can be used and run always in one direction, *i. e.*, no reversing of the machine. He obtains longitudinal motion of the screw with two of the rollers paralleled, and two smaller ones, with just as much of twist as will make up for the difference of angles due to two rollers of unequal size having the same number of grooves and cut to the same total pitch; for instance, *a* to 3=circumference of small roll, and *a* to 4 of large roller. The difference in these circumferences is equal to one revolution of a blank screw. The twist or reduction of angle on the small roller removes the line to 3^1 3, which makes the same angle as the large one, or 4^1 4.

Fig. 7



The two large rollers, then, are parallel, while the small rollers are brought to the same angle of grooves. They make the same number of revolutions in the same time. By the twist on the smaller rollers greater resistance to slipping is obtained, and the blank slips on the larger rollers, which thus become so far a nut, causing the blank to screw itself out



IMPROVED SCREW FORGING MACHINE.

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from the machine. Apparently, the three and four roller machines produce longitudinal motion by different means, but when examined closely the methods are similar.

In making left-hand screws on the three-roller machine, the obvious rule is to reverse the operation by cutting three grooves the opposite angle and then twisting or increasing the angle of the rollers until they equal four grooves. The same result may be obtained with the axes of the rollers in the same position for both in this way. For right-hand screws three grooves are cut, and their effect increased to four by the twist of the axes. In the same way, for left-hand screws, five grooves are cut on the rollers, and their effect as regards direction obtained by reducing them. The diagram, Fig. 5, illustrates the right-hand screw with three grooves—1 to 4 becomes x to 4; and for left-hand on the same axes with the rollers cut to five grooves, x to e becomes a to e.

Mr. Fairbairn proposes rolling fish bolts with right and left hand grooves on the same rollers, say three-quarter inch right-hand and eleven-sixteenths inch left-hand on the point of the bolt to act as a locking nut; and from the experience he has had, he sees nothing very difficult in doing it successfully. The two screws would be made at one operation of the machine, the blank being hot.

Experiments made by Mr. D. Kirkaldy show the tensile strength of the rolled screws to be considerably greater than that of the cut screws. We are informed that from 4,000 to 5,000 three-quarter inch coach screws, 4 inches long, can be made in a day with one machine. The wear of the rollers is very small as compared with the wear of cutters, and a machine may work for several weeks, we are informed, without change of rollers. Threads of any form may be made, square threads for railway couplings with right and left hand screws, and armor plate bolts being exceedingly well made. The section, Fig. 6, shows one of this kind. Fig. 7 shows smaller screws with different forms of threads.

AN ITALIAN ARTIST'S RESIDENCE—SIXTEENTH CENTURY.

In the picture herewith of Tintoretto's house we have a suggestion of the many-sided development of Italian art during the last days of its most glorious period. Here, before his death in 1576, in his ninety-ninth year,

TINTORETTO'S HOUSE, VENICE, 1576.

Titian may easily be supposed to have often spent many agreeable hours with one of the only two Italian painters then worthy to be his companions, and one destined to sustain for almost a generation after him the glory of that school of which Titian had been the bright particular star. The house itself, as will be seen, is just on the water's edge, access thereto, as in the case of most of the finest buildings and residences of Venice, being from gondolas. The city itself seems from every direction to be floating on water, and presents a unique appearance of fairy-like picturesqueness, while some of its buildings and monuments, bringing before us as they do the history of more than a thousand years, offer much that is worth the study of all who are interested in tracing the development of artistic ideas in architecture.

Air Injectors for Liquid Fuels.

The Forges et Chantiers Company of France have again brought forward the principle of burning liquid fuel for furnaces by means of air injectors, originally introduced by M. Sainte-Claire Deville. The use of steam to spray the naphtha, creosote, or other liquid fuel is a serious inconvenience on board ship, owing to the great consumption of fresh water which it renders necessary. The importance of this point is obvious, when it is remembered that the burner spray requires from one-twelfth to one-tenth of the total production of steam of the boilers.

Modern steamships are all fitted with engines of the surface condensing type, using high pressure steam. The water evaporated for the steam jet must be replaced by salt water, causing wear and tear of the evaporating apparatus and a certain amount of additional danger. In the case of a steamship of 3,000 tons, for example, about 530 cubic feet of water is evaporated every hour. Supposing the best type of steam atomizer is used, requiring only one-twelfth of the steam evaporated, or say 44 cubic feet of water per hour, then 486 cubic feet of water will go in the shape of steam into the engines, returning in due course, diminished only by small leakages, into the boilers. The 44 cubic feet of water required by the steam jet will escape from the chimney as steam. In the course of a ten days' run, such a ship would consume from the atomizing jets not less than 10,560 cubic feet of water, all of which must be drawn from alongside or distilled for the special purpose. Distilling apparatus for such a purpose is out of the question; and the alternative is not likely to recommend itself to sea-going engineers. It should not be forgotten, moreover, that the steam mixed with it in the spraying apparatus greatly diminishes the efficiency of the naphtha.

It is with a view to the removal of these objections that the spraying of the liquid fuel by air instead of steam has been revived. There are two ways of applying this principle: by using compressed air in place of steam, or by so modifying the burner that all the necessary air for combustion shall pass through it, and be mixed as intimately as possible with the combustible. The first method is easily arranged, the only additional apparatus required being a small steam pump in the boiler room to compress the air into a reservoir for the service of the injectors. To avoid waste of water, the exhaust steam from this pump is led into the condensers. The second method is more delicate, but is preferable, as it permits of the realization of high evaporation duty. It can be secured by a fan driving into the furnace (not at an extreme velocity) all the calculated volume of air supply, partly as a cylindrical jet and partly as an annular jet enveloping the former, leaving the liquid fuel to flow between the two portions, and be thus atomized and projected into the furnace.

An Ocean Oil Well.

Captain Eden of the British schooner Storm King, bound from Utilla to New Orleans, reports on Thursday, March 11, passing over a submarine mineral oil spring, bubbling and rippling all around the vessel, and extending out over 150 to 200 yards. This was in latitude 25° 48′ north, longitude 86° 20′ west, about 250 miles southeast of the Passes. At 11 A. M. they were over the spring proper, and at 11:30 A. M. outside the circumference of the oil circle. It is supposed that this spring is the oil cargo of a foundered vessel, which, breaking through the casks, caused this peculiar marine freak, or that it may be a natural phenomenon.

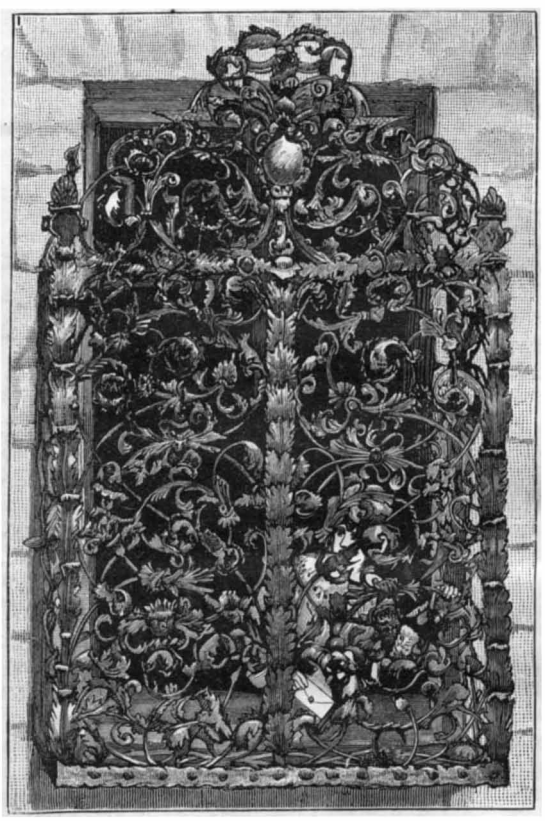
GROTTO OF MARIE DE MEDICI, THE LUXEMBOURG, PARIS.

ART IN THE GARDEN.

The magnificence of the historic palaces of France has been wonderfully diminished of late years, and their extensive parks and gardens, now no longer for the exclusive enjoyment of those of royal station or aristocratic birth, have been greatly curtailed. In the gardens of the Luxembourg there are now comparatively few relics of its former grandeur, but among these is the grotto of Marie de Medici, shown in our illustration, built some two hundred and fifty years ago. It is a broad basin, where the ladies of the court were wont to go and bathe, and though everywhere surrounded by trees, forms itself a sunny space that seems hewn out of the forest, the surrounding trees having formerly been kept trimmed and clipped above. The fountain and the highly ornamented miniature temple or arcade, the costly sculptures and the collections of rare flowers, make up a picture to delight the senses, and almost imperceptibly lead the imagination to conjure up the appearance of the brilliant throngs for whose enjoyment such lavish expenditure was made during the whole reign of Louis XIV.

A WINDOW GRILLE OF THE SEVENTEENTH CENTURY.

The accompanying engraving shows a very elaborate work of a German artist of the seventeenth century, in forged, chiseled, and hammered iron, having return ends, so that when fixed it projected in front of the window. It is now an exhibit at the National Industrial Art Museum at South Kensington, London. Its richness of effect as a decorative work, and great strength as a protection of a window, will be at once recognized. The design is divided into two panels, each balancing the other in the leading lines of the ornamentation, although there is also a suggestion of a cross in the whole. The division up the center and the side lines are made of acanthus leaves of hammered and chiseled iron laid over each other, the base of one leaf springing from behind the curved point of that below. The top is surmounted by a pediment having an oval escutcheon in the center, divided from the square of the grille by foliation starting horizontally from each side. The details are of a very ornate character, most of the work having been shaped while hot and chiseled afterward, while some grotesque terminal figures are introduced, which are entirely forged, and afterward finished with chisel and file. The artist's fancy has led to the introduction, also, of a suggestion of probably prohibited correspondence with the out-



WINDOW GRILLE.

side world on the part of some fair occupant of the apartment behind the grille.

Artificial Cocaine.

Merck is said to have prepared cocaine by synthesis. Cocaine is benzoic methylecgonine. Benzoic ecgonine is treated with iodide of methyl in slight excess in the presence of methylic alcohol at 100° C.; the excess of iodide and methylic alcohol is driven off by heat; from the resulting sirupy liquid cocaine is extracted. This artificial cocaine melts at 98°, like its prototype, and it possesses all the reactions of the natural product.

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TREE TOADS.

C. FEW SRISS.

These arboreous batrachians quit their places of hibernation, and resort to ponds and other bodies of water, about the latter part of April or first of May, where they couple, and the female deposits her spawn or eggs. These are generally attached in clusters of three or four, and strung along the surface of the water, fastened to grass or water plants. The eggs hatch in two or three days, according to the temperature—cold retarding and heat accelerating the hatching. The little tadpoles have branching gills, as with the frogs generally, for about a week, when they disappear. In a little less than two months their legs and arms are fully developed, the tail is entirely absorbed, and they quit the water, perfect little tree toads.

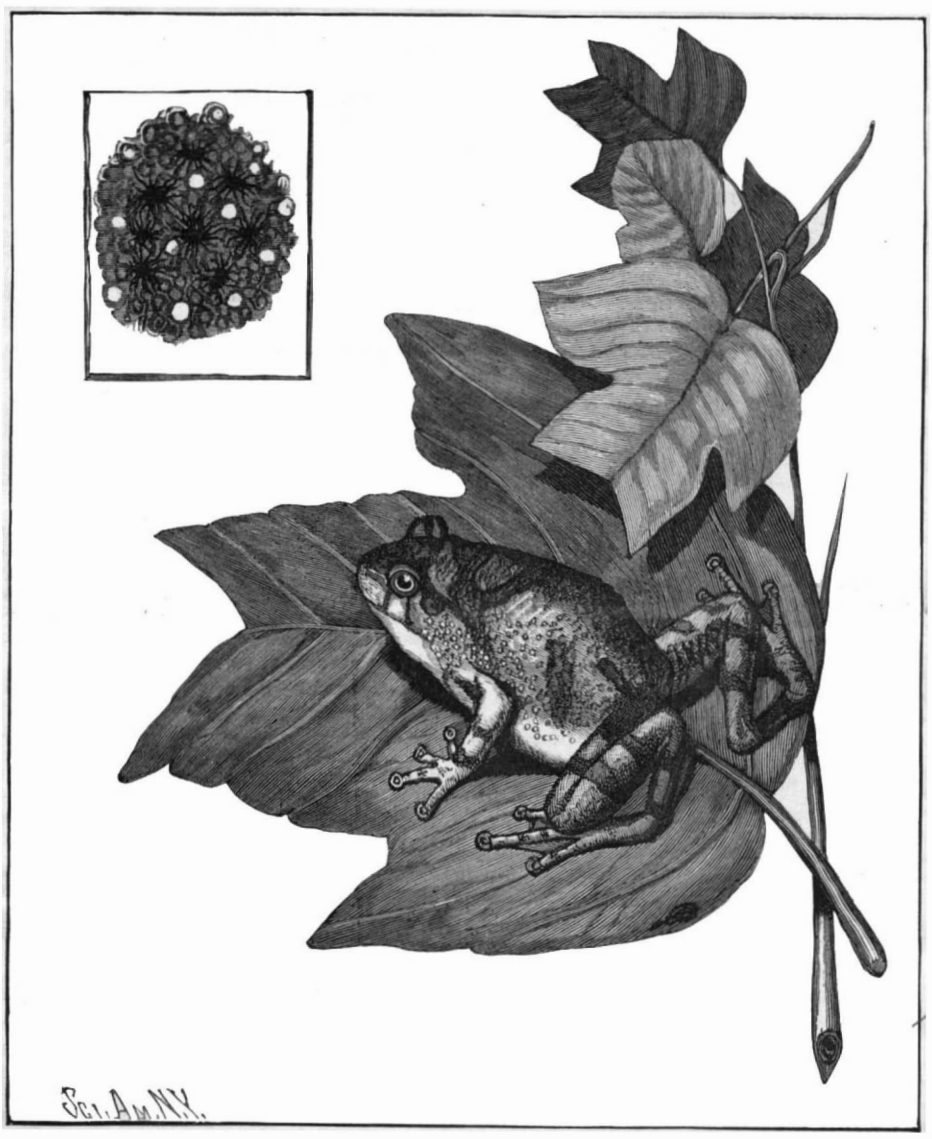
When mature, they are generally solitary in habits, each toad having a particular tree for his habitation, mostly one containing a hole or crevice, into which he can retreat from the rays of the hot summer sun. A toad has been known to resort to the same tree for many years in succession. They are also found on old rail fences, but as they so nearly resemble the gray color of the fence rails, they are generally passed by unnoticed. In the month of October they creep into the soft earth, some sheltered crevice, or the decomposed debris under some old tree or rotten log, where they hibernate until the following spring.

I have had many of these tree toads in captivity for months at a time, and their prevailing color was pale ash, tinted here and there with delicate pale green, although they would assume various tints of gray and grayish-green.

During bright and sunny days they generally remained quiet in some corner, in a squatting position, with their legs closely drawn under their bodies; but toward evening would become active, springing and creeping from one side of the vivarium to the other for the greater part of the night. They could walk easily upon the glass, but if they stopped for an instant would slide slowly downward. They would seize with the tongue, and devour, all small insects given to them, and also half-grown earthworms, but they seemed to be afraid of large beetles and grasshoppers. Indeed, I have known the larger frogs to permit certain grasshoppers to escape after having been seized, because their tongue and jaws were so severely scratched by the grasshopper's strong and spiny leaping legs.

The upper figure shows the structure and pigment or spider-like cells of a piece of skin from the back of an adult tree toad, as seen under the high power of the microscope. The change of color is thought to be produced by the emptying or filling of these minute pigment cells. The change of tone from gray to green seems to be entirely at the will of the animal, and not caused by anger or fear, like blushing or pallor in man, as some have suggested. I have observed that neither frightening nor teasing would cause them to change from their normal color. The name of our noisy little tree toad is *Hyla versicolor*. Its form is toad-like, but more flattened; skin more or less warty above and granulated beneath.

Color changeable, from pale ashy-gray to delicate green and grayish-brown; back and sides blotched with irregular dark marks, sometimes conspicuous, at other times obscure. Generally a whitish spot under each eye. Abdomen white, yellow near the thighs. Legs, ash color above, with several transverse bars or spots of dark gray or brown, beneath yellow. Fingers, four; toes, five, well webbed or palmated—each of the digits ending in a cutaneous globule or disk. Length (from nose to vent) of a full grown adult, $1\frac{3}{16}$ inches. It has been found from Great Bear Lake south to Georgia and Louisiana, and from the Atlantic States westward to Michigan and Kansas.



THE TREE TOAD (HYLA VERSICOLOR).

THE *Northwestern Lumberman* thinks there is no reason to doubt that woods have what may be called their affinities. It has been stated on authority that has not been questioned, that certain woods (both dry) when placed in contact will soon rot, but when in contact with other woods will not rot. It would be reasonable to suppose that the nature of a piece of wood has its likes and dislikes, that it will repulse and attract; in other words, that it is affected by that with which it comes in contact. Were it not so, it would be an exception in the mineral, animal, and vegetable kingdoms.

A New Sewage Process.

BY A. MC DONALD GRAHAM, F.C.S.

In carrying out my experiments, I have observed that when a large excess of pyrites is acted on by the process, sulphurous anhydride is formed and passes off in the gaseous state, and sulphate of iron remains in the mixture. If any oxide is added to the mixture, such as oxide of zinc, iron, or manganese, then a sulphate of the metal is also obtained.

In order to obtain a good sewage precipitant by this process, an oxide must be selected which will form a stable salt with sulphuric acid, and is not liable to peroxidize, and which can also be acted on any number of times; and it is absolutely necessary that this oxide should exist in large quantities, and be obtainable at a moderate price. Binoxide of manganese fulfills these conditions; and in order to form my sewage precipitate, I take this oxide and add to it iron pyrites in a fine state of division, more than sufficient to convert the whole of the oxide of manganese into sulphate. As a medium for conveying the oxygen of the air to the mixture I use about 5 parts of finely divided clay to 1 part of manganese. This is cheaper than carbonate of soda, though somewhat slower in its action, and in the many experiments I have performed I have found that very few samples of clay are attacked during the operation. After well mixing the powdered binoxide with the pyrites and fine clay, I place them in a muffle furnace, and heat the mixture, gently at first, and afterward to incipient redness, or about 1,000° to 1,200° Fah. After heating for about three or four hours, the oxidation will generally be found to be complete, and the whole of the manganese will be converted into sulphate, together with a part of the iron. The mass when cool should be sprinkled with water, and allowed to remain in a damp condition for a week or more.

Two chemists of much experience as practical analysts have examined the process quantitatively, operating upon 3 or 4 pounds of the mixture, and have obtained excellent results.

In operating on the sewage, the sulphates of manganese and iron may be used with a certain proportion of clay, which is a well known defecator of sewage. Charcoal may also be associated with the manganese, etc., if the sewage is much discolored. Should the sewage be acid, from the influx of chemical refuse or any other cause, it will be necessary to use a little lime; but in a general way the sewage will be found to be sufficiently alkaline to insure the precipitation of the manganese and iron, and the constant use of lime should be avoided. An effluent water obtained by the addition of much lime to a sulphate of alumina or iron has been found by experience to generate sulphureted hydrogen and other offensive gases.

The effect of clay in carrying down organic matter may be demonstrated by a simple experiment. Take 10,000 grs. of fresh urine, and, after allowing it to stand for two hours, agitate it well with 50 grains of clay previously dried and powdered. No alteration will be apparent in the urine at the close of the operation; but on carefully collecting the clay on a filter, and drying it at a temperature below 100° C., it will be found by the soda lime process to contain about 4 to 5 per cent of ammonia. Of the action of the charcoal it is unnecessary to speak.

In order to convert the sewage mud into a useful precipitant, it must first be dried. Formerly the drying process was attended with much difficulty and expense, but as the nature of the product to be treated has become better understood, the drying difficulty has been to a great extent surmounted. It is found by experience that after such a precipitating medium as alumina, iron, or manganese has passed through the sewage, it has acquired a new property—that of spontaneous heating when mixed with organic matter, etc. If, therefore, the mud obtained by the use of such precipitants on the sewage be deprived of superfluous water by means of a filter press, and placed in heaps in a sheltered situation, a natural heating takes place, the thermometer frequently rising as high as 180° Fah. when inserted in the middle of the heap. This faculty of spontaneous heating has been attributed, and I believe correctly, to the small quantity of phosphoric acid recovered from the sewage by the precipitating medium. After this heating process has taken place, the mud will be found to be in a dry and friable condition, and can be readily brought into a fine state of division. It should then be furnaced with sufficient iron pyrites to reconvert the manganese and iron into sulphates. The oxidation of the organic matter by this process is very complete, and not the slightest nuisance is caused by the operation.

Iron pyrites (smalls) are now practically unsalable, and exist in enormous quantities. If copper pyrites are used, arrangements can be made for recovering the copper. It is estimated that a ton of the precipitating mixture, containing about 15 per cent of the mixed salts of manganese and iron and 85 per cent of fine clay, can be prepared for about 16 shillings, and the mud can be regenerated for about 8 or 9 shillings per ton.

The effluent water produced by the use of the clay, sulphate of manganese, etc., is clear and free from smell. It will keep for any length of time in an open or close vessel without giving off unpleasant gases or developing organic germs.—*Chem. News.*

A New Saccharine Substance.

A new sweetening agent has been produced from coal tar. It is known to chemists as "benzoyl sulphuric imide," but it is proposed to name it "saccharine." The discoverer is Dr. Fahlberg, and its preparation and properties were recently described by Mr. Ivan Levinstein at a meeting of the Manchester Section of the Society of Chemical Industry. Saccharine presents the appearance of a white powder, and crystallizes from its aqueous solution in thick, short prisms, which are with difficulty soluble in cold water, but more easily in warm. Alcohol, ether, glucose, glycerol, etc., are good solvents of saccharine. It melts at 200° C., with partial decomposition. Its taste in diluted solutions is intensely sweet; so much so, that one part will give a very sweet taste to 10,000 parts of water. Saccharine forms salts, all of which possess a powerful saccharine taste. It is endowed with moderately strong antiseptic properties, and is not decomposed in the human system, but eliminated from the body without undergoing any change. It is about 230 times sweeter than the best cane or beet-root sugar. The use of saccharine will therefore be not merely as a probable substitute for sugar, but it may even be applied to medicinal purposes where sugar is not permissible. One part of saccharine added to 1,000 parts of glucose forms a mixture quite as sweet as ordinary cane sugar. The present price is 50 s. per pound, but although very high, this is not prohibitory, as its sweetening power is so great; but it is very probable the cost of its manufacture will soon be very considerably reduced. The *Brewers' Guardian* says: "This new compound will be of great interest to brewers, for not only is it perfectly wholesome, but it possesses, in addition to its intensely sweet taste, decided antiseptic properties, and therefore may be usefully and advantageously added to beer."

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ENGINEERING INVENTIONS.

A car brake has been patented by Mr. Charles M. Sturgis, of Birmingham, Ala. The mechanism consists of levers pivotally connected with the truck and brake heads, a movable guide block through which the long arms of the levers project, and a chain leading to the ordinary manipulating mechanism, with other novel features.

An elevated railway track and car has been patented by Mr. Alfred Speer, of Passaic, N. J. The car is suspended by rods from the outside of suspension wheels, the seats are placed on the side of the body next to the posts, with the aisle on the outside, the ends of the car bodies are pointed or cigar shaped, and there are guide rails, yielding steady wheels, and other novel features.

A car coupling has been patented by Mr. Alfred D. Babcock, of Leon, N. Y. The drawheads slide in suitable guides attached to the framework of the cars, each having buffer springs, a pocket and pin, with other novel features, whereby cars may be automatically coupled, or the coupling may be used as a common link and pin device, where only one car has the improved form.

A car coupling has been patented by Mr. Frederick Yeiser, of Danville, Ky. The invention consists in the special construction of the link supporter in combination with a common drawhead, to hold the link in the drawhead at any required angle of elevation or depression, to enter a higher or lower drawhead, and throw the holder out of position as soon as the service is accomplished.

A motor attachment for locomotives has been patented by Mr. Edwin J. Strong, of Laingsburg, Mich. The drive wheels have side pulleys which are connected with pulleys on one or more following sets of wheels by a sprocket belt, to prevent slipping of the drive wheels and increase the tractive power of the locomotive, there being yielding pulleys to facilitate the rounding of curves.

A steam engine has been patented by Mr. Benjamin T. Webb, of Beaufort, N. C. The main shaft has a friction wheel, and a yoke is carried by the piston rod, arranged to alternately engage opposite sides of the friction wheel, with means for bringing the yoke into engagement with one or the other sides of the friction wheel, to convert reciprocating into a rotary motion without crank, racks, and pinions.

AGRICULTURAL INVENTIONS.

A farm gate has been patented by Mr. Edwin H. Penfield, of Santa Barbara, Cal. This invention is an improvement of a former patented invention of the same inventor, and consists principally of a special construction of the lever or hinge rod and of means connected therewith for operating double gates.

A plow has been patented by Mr. Geo. W. Wright, of Carterville, Mo. This invention consists in combining with the mouldboard and landside the means for maintaining them in a heated condition, to avoid the necessity of maintaining a high polish on the face of the plowshare, mouldboard, and landside, and facilitate the turning of adhesive soil, reducing the power required to draw the plow.

A corn planter has been patented by Mr. George S. Agee, of Louisville, Kan. Combined with a dropper shaft and laterally adjustable seed dropping cylinder having rows or cavities is a check wheel with peripheral groove and transverse notches corresponding with the rows of the cavities, with other novel features, to make a corn planter which is strong and simple to build, and in which the seed-dropping mechanism can be operated by hand if desired.

MISCELLANEOUS INVENTIONS.

An annealing oven for glass has been patented by Mr. Frank Schefold, of New Albany, Ind. Its walls, floor, and ceiling are composed of hollow bricks, arranged to form a series of flues on all sides of the furnace, whereby provision is made for heating and cooling the oven very rapidly.

A playing card has been patented by Mr. Edgar J. Levey, of New York city. The invention consists in combining with the symbol of a suit any mark which shall distinguish it from a suit of the same color, and particularly in the application of a distinguishing mark to the marginal symbols of the cards.

A fence has been patented by Mr. Jos. R. Standley, of Platteville, Iowa. It is constructed with a bar arranged horizontally a short distance above the ground, with spikes and staples in its upper side, to make a simple form of fence which will allow cattle to pass freely over it, but prevent the passage of swine.

An automatic weighing scale has been patented by Mr. Jacob Ball, of Waterloo, Ont., Canada. This invention covers a novel construction and combination of parts and details for making scales whose parts shall be simple, and which are adapted to be adjusted very easily for weighing bodies of different weights.

A sash fastener has been patented by Mr. John F. Porter, of Mount Washington, Ky. It consists of a novel device of spring and lever lock, which is simple and strong, readily applied, not liable to break, and which has no binding action on the window stop when raising or moving the sash.

A folding table has been patented by Mr. Daniel A. Fay, of West Brattleborough, Vt. This invention covers a novel construction and combination of parts for a folding table, simple to make, which can be folded very compactly, and can be quickly set up and taken down.

A water closet has been patented by Mr. William D. Schuyler, of New York city. This invention covers certain novel devices for more securely closing, when not required to be open, drain pipes at or near their connection with water closet pans, wash bowls, sinks, bath tubs, or other similar fixtures.

A holder for paper bags has been patented by Mr. Sylvester W. Sheldon, of Jersey City, N. J. It is simple in construction and inexpensive to manufacture, and is so made that it can be readily applied to hold toilet paper, paper bags, and other similar articles.

A fruit drier has been patented by Mr. Hugh S. Jory, of Salem, Oregon. It is a special arrangement of upright drum heater, with small furnace without grate in its base, being an improvement on a former patented invention of the same inventor, to make such apparatus more convenient and effective.

Hollow ware forms the subject of a patent issued to Mr. William H. Hoyt, of Stamford, Conn. The ware is made of the pith of cornstalks cut into small curved or angular blocks and connected together with glue or other adhesive material, the ware being suitable for vases, jars, boxes, and other ornamental purposes.

An ironing table has been patented by Mr. Emanuel Ruse, of Lovettsville, Va. It has hinged legs in connection with angle irons with apertures, one arranged to adapt it to lap on the other, with a pin for securing both irons to the floor, the invention being an improvement on tables supported by legs adapted to fold.

A plow has been patented by Mr. Adolph Westling, of Ortonville, Minn. It has novelties in construction to provide that the horses' shoulders will not be injured should the plows strike an obstruction, there being yielding springs to prevent sudden jar, and the plow can be readily arranged to enter the ground to any desired depth.

An electric horse unhitcher has been patented by Mr. Andrew J. Coffee, of Portland, Oregon. Combined with an electro-magnet is a lever with a stem loosely carrying an armature, a spring for pressing the armature upward, with other novel features, for automatically unhitching horses in engine and truck houses on a given signal.

A bush hammer has been patented by Mr. William Oppy, of Westerly, R. I. This invention consists of two gibs placed between the side plates, and provided with a tongue which fits into corresponding recesses in the cutting tools, whereby the latter are securely held, or can be easily taken out for sharpening or other purposes.

A gate has been patented by Mr. Jesse H. Barton, of Brownsville, Tenn. It has battens so arranged that its horizontal bars may be conveniently depressed, or it may be easily adapted to provide a passageway for chickens and small stock, in connection with various novel features of construction and the combination of parts.

An ice tongs has been patented by Mr. Eli A. Collins, of Huntington, Ind. The tongs are so made that when closed the handles will be at a distance apart, to prevent injury to the hands, and the handles are formed separate from the prongs, with straps and slots, that they may be secured to the prongs in any convenient manner.

A cotton gin has been patented by Mr. Samuel D. Freeman, of Fort Thomas, Arizona Ter. This invention covers a novel construction for removing cotton fiber from the seed without breaking it or bending it sufficiently to injure it, leaving the fibers straight and parallel, and of nearly quite full length as grown on the seed.

A map and window shade case has been patented by Mr. John M. Sauder, of Harrisburg, Pa. The case is provided with a spring roller, and is so made that maps and shades can be readily displayed and closed up, and when closed the case will exclude dust and water, and can be readily transferred from one place to another.

A washing machine has been patented by Mr. John M. Headen, of Pleasant Hill, Mo. A rotatable clothes-holding rack is arranged in a covered tub in such a way that the clothes will be forced through the washing fluid by the rotation of the rack, and thus quickly cleansed without injuring them, the apparatus being simple and inexpensive.

A pencil sharpener has been patented by Mr. Frank Worn, of Philadelphia, Pa. It has an exterior case with a recess and a detachable holder fitted thereto, with a series of sharpening blades, so contrived that the pencil will be held firmly and centrally between the blades, so as to make a sharp point without danger of breaking it off.

A device for withdrawing the pipes from driven wells has been patented by Mr. James Mericle, of Patchogue, N. Y. It consists of two grappling jaws made concave on their adjacent faces and linked together, one of the jaws having a clevis or other device for attachment to a chain or other connection for applying power to the grapplers.

A window bead fastener has been patented by Mr. Charles R. Nelson, of New York city. Combined with a stop bead are washers and screws, the latter passing through apertures large enough to permit moving the bead slightly in all directions, for the more ready adjustment of stop beads in relation to window sashes, to prevent rattling.

A folding top for school desks has been patented by Mr. William P. Conner, of Bloomsburg, Pa. The desk has an opening in its front and a leaf for closing the same, cleats projecting beyond the edge of the leaf, and links pivoted to the inner sides of the desk, with other novel details, making a folding top which also closes the opening in the box of the desk.

A child's carriage has been patented by Mr. Patrick Gallagher, of New York city. It has a fan supported on the rear part of the carriage and set in motion by a belt and pulleys actuated by the rotating axle, to which one set of wheels is rigidly attached, so the occupant will be fanned when the vehicle is in motion.

An electric signal recorder has been patented by Mr. Andrew J. Coffee, of Portland, Oregon. Combined with clockwork and an electro-magnet is a printing lever, an additional clockwork for feeding a strip of paper, and other novel features, making an improved device for giving fire alarm signals, and for recording the signals by ink impressions.

A screen for bird cages has been patented by Mr. Samuel A. Bishop, of Smethport, Pa. It is of glass or sheet material, to be conveniently held by a simple form of hook outside the cage, opposite the bath tub and seed cup, to prevent birds from scattering water and their feed about, to the damage of the wall or furniture.

A fastening for pocket book, purse, and hand bag frames has been patented by Mr. Louis B. Prahar, of Brooklyn, N. Y. Combined with a frame having a recess, a pivoting wire, and a torsion spring, is a latch with a rearwardly projecting flange to come in contact with the side of the frame, so the latch will not be turned so far back as to break or injure the spring.

A metal polishing composition has been patented by Messrs. Zebulon Jacobs and William Horne, of Salt Lake City, Utah Ter. It can be used on gold, silver, zinc, copper, brass, and tin, without scratching, and consists of tripoli, coal oil, camphor, spirits of ammonia, and spermaceti, combined in specified proportions and made into a paste.

An end gate fastener has been patented by Mr. Joseph M. Reams, of Curwensville, Pa. This invention relates to devices for fastening the end gates of wagons or other vehicles, and has for its object to provide simple, inexpensive, and effective fastenings, which may be quickly and easily operated, and readily applied to new or old vehicles.

A wire fence machine has been patented by Mr. William J. Raymond, of Cherry Vale, Kan. Combined with a truck is a series of twisters mounted thereon, with mechanism for beating up pickets, devices for moving the truck operated by the beating up mechanism, and other novel features, for building fences of twisted wire, and pickets or rods held by the wires.

A cotton cleaner has been patented by Mr. John H. Poston, of Eufaula, Ala. It has a revolving screen and air-exhausting device, with specially arranged passages, to withdraw the dust and dirt from the gin room and the condenser, whereby the lint is straightened out into better fiber, and the room rendered healthier and more comfortable.

A stump extractor has been patented by Mr. Alexander Logan, of North Sydney, Nova Scotia, Canada. It consists of a simple frame carrying a shaft and gear wheels, in connection with hook arms and chains, the machine to be anchored to another tree or stump, when a powerful leverage is easily brought to bear on the stump to be removed.

A mosquito canopy has been patented by Mr. Robert Mitchell, of Atlanta, Ga. This invention comprises a top adapted to support the sides of the canopy fabric and connected to a hanger or arm support, having opposite hinged frames with side arms which engage each other, so that by drawing on one arm both frames will be opened for the escape of insects in the space inclosed by the canopy.

A hair tonic has been patented by Mr. Leon Pierre Federmeyer, of Leadville, Col. It consists of tincture of Peruvian bark, tannin, sulphuret of potash, common salt, alcohol, water, and a perfume, compounded in proportions and after a manner specified, to prevent and remove dandruff and stimulate the growth of the hair, while being also a useful application for the skin.

An apparatus for emptying privy vaults has been patented by Mr. Louis R. Sassinot, of New Orleans, La. It is a combination and arrangement of a water tight tank or reservoir, either on a wagon or making part thereof, with various special parts and devices, and a disinfecting fluid and gas pipe and burner, whereby the obnoxious gases are destroyed, and vaults may be emptied by day as well as night.

A log pusher for saw mills has been patented by Mr. Robison W. Shelbourne, of Blandville, Ky. Pushers are fitted in slide ways arranged transversely to the carriage and outside of a truck or trough on which the logs are brought into the mill house, mechanism operating the pushers from the mill driving shaft, whereby the log is automatically pushed from the log truck on to the mill carriage.

An apparatus for dyeing has been patented by Mr. Joseph Hanson, of Philadelphia, Pa. Combined with a vat is a frame adapted to move horizontally, in connection with another vertically moving frame, whereby the hanks or bunches of yarn may be dipped into and withdrawn from the coloring solution automatically, in imitation of the motion of doing the work by hand.

A music satchel has been patented by Mr. Eugene Thayer, of New York city. It has a flexible cover, attached to the inside of which at each end is a pair of semi-ovoid end pieces, so arranged that when pieces of music are placed in the satchel their edges will nearly meet at the mouth, and the sheets will not receive a permanent curve to prevent their being again placed smoothly on a music rack.

A vehicle spring has been patented by Mr. James R. Wright, of Portland, Oregon. This invention relates to springs mainly adapted for use on side bar vehicles, and covers a novel construction and combination of parts and details, whereby the spring plates are not subjected to any lateral or torsional strain, and so the spring will at all times regulate itself to the weight imposed upon it.

A steam radiator has been patented by Messrs. John Barnett, of New York city, and Charles S. Bavier, of Brooklyn, N. Y. The valve shell or casing is formed in one end of the steam chest or base, and contains a double valve, the spindle of which turns in end pieces screwed in the sides of the chest or base, and forming the ends of the valve chamber, and there are also other novel features of construction.

A cigar rolling machine has been patented by Mr. James W. Cameron, of New York city. It is operated by treadles, a suitable bunch of tobacco for the intended cigar being placed in a recess, where it is pressed and rolled into a shape, when a wrapper cut to proper shape is introduced at the butt end, and so held by the operator that it will be spirally wound around the cigar to quickly complete the manufacture.

An oil separator has been patented by Mr. Eugene Polte, of Magdeburg, Germany. It is an apparatus combining a steam nozzle with a cylindrical vessel held below it, the nozzle having a channel for conducting the water of condensation and oil into the vessel, with an outlet pipe especially arranged, and other novel features, to separate oils and fats from the water of condensation and exhaust steam.

A centrifugal speed indicator has been patented by Mr. Henry Herden, of Corning, N. Y. It consists in a slotted shaft and a two-armed lever pivoted therein, with weights on the ends, in combination with an index and a spring for opposing the centrifugal action of the weights of the lever, with means for preventing the vibration of the weighted lever when the indicator is running at low speed.

A lamp for magic lanterns has been patented by Mr. Thomas H. McAllister, of New York city. The wick tubes are arranged diagonally with reference to the axis of the lenses, so the two flames from which the light emanates overlap each other, thereby avoiding the dark space, and there is a metallic chimney with enlarged portion, a reflector, and a removable glass window.

A process of photo-engraving has been patented by Mr. Charles T. Iago, of 55 Riversdale Road, Highbury, Middlesex Co., England. It consists in first engraving the subject on wood in intaglio, then producing the necessary contrast between the lines and surface of the block and photographing direct therefrom, producing the relief block from the negative by any known photo-chemical or other method.

Card clothing for carding engines forms the subject of a patent issued to Mr. John T. Fallows, of Denton, Lancaster Co., England. Combined with a carding band on which carding teeth are held is an additional or supplementary belt, made of metal, to prevent the teeth on the band being forced out of position or partly driven back through the foundation of the band.

A combination garment has been patented by Mr. Abe. W. Mensor, of Jacksonville, Oregon. It is a lapel vest and overshirt with lapel bosoms, and a detachable series of cuffs and collars, whereby three garments are combined in one, a vest, overshirt, and white or colored shirt or shirt front with cuffs and collars to match, the invention being an improvement on a former patented invention of the same inventor.

A fence has been patented by Messrs. Robert Black and John Strachan, of New York city. It is made of tubular iron, and designed more especially for use on elevated railway and other structures where the foundations are subjected to motion and jar, the horizontal bars or rails being secured in the posts by screw caps applied to couplings through which the rails pass, clasp rings of soft metal being used in the caps to grasp and hold the rails.

A drill chuck has been patented by Mr. Charles E. Stone, of Amesbury, Mass. Combined with a hollow shaft having a countersunk outer end is a sleeve fitting over the shank, having a conically bored end, and a pair of blocks having beveled ends, which are received between the conically bored end of the sleeve and the countersunk end of the shank, with other details, for holding drills and other implements in position for use.

A beer pump has been patented by Mr. Patrick R. Greene, of Brooklyn, N. Y. The pump cylinder is of glass, and its ends have externally screw-threaded rings, combined with metal mountings provided with shells of non-corrosive metal, so that when the mountings are screwed to place liquid-tight joints will be formed between the cylinder and the non-corrosive shells, making a non-corrosive pump for drawing beer and other malt liquors.

The manufacture of tiles forms the subject of a patent issued to Messrs. Joseph Bayer and Emil Puchta, of Washington, Mo. The process consists in first washing the clay with water and passing it through a sieve, then drying, grinding, pressing into form, and finally baking, in order, with a purified clay, to make a tile of increased hardness and durability, which will not absorb water, and will afford protection against slipping.

A phaeton spring has been patented by Mr. William J. Wayne, of Decatur, Ill. On the head block supported by the fifth wheel is secured a half elliptic spring, the ends bent upward and connected by shackle joints with the front ends of quarter elliptic springs secured on the under side of the body, all so arranged as to simplify the construction of the vehicle, avoid disagreeable motion, and allow the use of high buggy wheels.

A compensator for wire ropes and cables has been patented by Mr. Richard B. Ireland, of Trenton, N. J. Combined with the operating ropes or cables of a semaphore are a shifting lever and two wheels independently journaled, over which the operating ropes pass in opposite directions, eccentrically pivoted levers engaging the rope-carrying wheels and connected with the operating level, to allow for the expansion and contraction of wire rope and cables in operating signals at a distance.

A tube expander forms the subject of 3 patents issued to Mr. William I. B. McHale, of New York city. This invention relates to an improvement in tube expanders employing rollers having their axes journaled or movable in slots in the heads between which the rollers are disposed, the tubular stock having longitudinal slots extending from the rear end to within a short distance from the front, in which slots cylindrical swages or rollers are held by a flanged ring surrounding the rear end of the stock loosely, with other novel features and combinations of parts and details, in an implement for expanding the ends of tubes, and so the implement can be used in tubes of different diameters.

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Special.

THE OLDEST METHODIST MINISTER IN PHILADELPHIA.

"I am the youngest old man in New York," said the Hon. William E. Dodge, a short time before he died. Mr. Dodge was indeed one of the sprightliest of old gentlemen. He was as active as most men of fifty, although he was about seventy-five. Up to the time of his death, which came very suddenly, he was able to accomplish more work in a day than almost any of his partners or clerks could get through with.

In Philadelphia lives another "young old man," one of the most venerable of Methodist ministers. He is as active, as hearty, and as cheery as was Mr. Dodge. He is the Rev. Anthony Atwood, honored and beloved not only by Methodists, but by good people of every persuasion. Mr. Atwood might pass for a man of about sixty, but he is eighty-five. About fifteen years ago he told the writer that he hardly expected to do much more work, and that he thought a man of seventy might be considered to have rendered all the effective service he would be capable of. Yet, since that time, Mr. Atwood has done more ministerial work than many a younger man has accomplished. Some years ago he had a partial stroke of paralysis, which for a while disturbed his general health. He also suffered from a bronchial difficulty which threatened to be serious. From both of these disabilities he has now entirely recovered. With his snow-white hair in its ample fullness, and his clear and ruddy complexion, he is the picture of a model patriarch, both in health and good nature. Although it is some time since Mr. Atwood has been in pastoral charge of a church, he preaches frequently, and is regularly at the Green Street Methodist Episcopal Church on Communion Sundays, taking part in the sacramental service.

The writer recently called on this venerable clergyman at his home, No. 809 North Seventeenth Street, Philadelphia, and found him as cheerful and vivacious as in former years.

"Well, Mr. Atwood, it looks like old times to see you looking so vigorous and hearty; but years do not seem to make you an old man, and you appear to enjoy quite as good health as most of the younger men."

"My health," said Mr. Atwood, "is all I can expect, considering my age, which is now close to eighty-five. Since the stroke of paralysis which I had several years ago, I have not been able to preach with my former vigor. I find that I am not capable of a prolonged pulpit effort as of old. Words do not follow my thoughts as quickly as they used to. But with this exception I am about as well as I have been for many years."

"When I had that stroke of paralysis," continued Mr. Atwood, "I resorted to a treatment which I found had been of great value to many others who were similarly affected. I had for many years known Dr. Palen, of Messrs. Starkey & Palen, who have done so much good with their Compound Oxygen, and I consulted him in reference to my case. I took the treatment at the office, which was then in Girard Street. At once I began to receive benefit. For some time I visited the office regularly and frequently. I took inhalations of the Oxygen until my health was so fully restored that I was in no further need. It gave me a new vitality, restored my general health, and put my whole system in renewed good order."

"You had some bronchial difficulty, did you not, Mr. Atwood?"

"Yes; I had an irritation in my throat which was quite troublesome, and threatened to be more so. I tried Compound Oxygen for this also, and was surprised not only to find the completeness of the relief it afforded me, but the readiness with which it acted. I procured a "Home Treatment" in order to cure this bronchial trouble at my leisure; supposing the irritation would be slow to go away, as it is in the case of many clergymen, who, after long years of pulpit service, are attacked with soreness of the vocal organs. But I had occasion to use only a small portion of what was contained in the "Treatment." My throat became so much better that I had no occasion again to resort to the use of Oxygen."

"And have you, since your recovery, had much occasion to use this remedy, Mr. Atwood?"

"Not a regular thing, at all; only at long intervals. Once in a while, if I need a general toning up of my system, I call at the new office of Drs. Starkey & Palen—which, by the way, is an exceedingly beautiful and convenient place—and I take a few inhalations. From this I always receive benefit and strength."

"You are, then, a firm believer in this method of treatment?"

"Yes, very, very firm. You may say that I most heartily and thoroughly approve the treatment, and indorse Drs. Starkey & Palen as gentlemen whom I have known for years, physicians of repute and ability, in whom I have entire confidence. They have done incalculable good with Compound Oxygen. I am glad that so many invalids have been brought to health by this means. I am glad, too, that people are becoming more generally acquainted with it."

The experience of Mr. Atwood is an evidence that the virtues of Compound Oxygen are not only for the advantage of the young and those in middle life. There are many other instances on record in which persons advanced in years have received, by means of this great vitalizer, renewal of health and prolongation of life. For further reference to these and for better acquaintance with the merits of Compound Oxygen write to Drs. STARKEY & PALEN, 1529 Arch Street, Philadelphia, Pa., for their pamphlet treatise, which will be freely mailed to any address.

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The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) J. W. asks: 1. Will a brass pipe expand in length as a pressure of steam is gradually let into it? A. Yes. 2. How much in length will a brass pipe 4 feet long by 1 inch inside diameter expand as steam pressure in it rises from 0 to 30 pounds, also 60 pounds? A. 0·1 inch and 0·114 inch respectively. 3. Is there any metal, as a rod ½ inch diameter, which, if placed within the pipe, will contract or remain stationary, or nearly so, as the pressure rises? A. None. 4. Will a large brass pipe expand more or less than a small one? A. The same.

(2) H. C. M. asks: What will harden soft spots in a grindstone and leave it so it will wear away evenly? A. We know of nothing that will penetrate and harden the spots.

(3) F. A. W. says: I have made a Voss-Holtz electrical machine with a revolving plate 8 inches in diameter. It will when in good working order give a 2 inch spark, but is constantly changing or rather reversing its poles. I had the same experience with a simple Holtz and also with a Wimshurst machine. Kindly give reason and remedy through your paper. A. Sometimes this happens owing to a slight displacement of the armature or stationary plate. See that it is free from liability to move.

(4) J. P. A.—The extreme depth of water in the Mersey River over the tunnel is, at high tide, 90 feet. The average thickness of solid rock between the bed of the river and crown of the tunnel is 30 feet, and nowhere less than 25. The height of the tunnel is 21 feet. The Nicaragua Canal would pass through a much healthier climate than the Panama Canal; the obstacles would not be so stupendous; the line to be cut would be less, as Lake Nicaragua would be utilized; it would present a shorter line from the North Atlantic to the North Pacific; but it would have to employ locks. The cost would be less both in men and money.

(5) "Inquirer" asks the method of finding the height of a conical frustum containing 20 ponnds of lead, the diameters of its faces being 3 inches and 1¾ inches respectively. A. The volume of 20 pounds of lead must first be found. The specific gravity of the metal being 11·363, and the weight of a cubic foot of distilled water at 0° C. being 62·418 pounds, it is a simple calculation to find the number of cubic inches of lead which will weigh the required number of pounds. This must then be put equal to the volume of a conical frustum which is given by the following formula:

$$v = \tfrac{1}{3}\, h \left(a^1 + \sqrt{a^1 a^3} + a^3\right)$$

in which a^1 and a^3 are the respective bases and h the height. The area of a circle being πr^2, we have all the data in the above equation except h. But we have found the value of v by the previous calculation. The equation may therefore be solved for h, giving us the result desired. Or, the formula may be stated as follows, omitting the separate calculation of the areas of the two circles:

$$v = \tfrac{1}{3}\, \pi h\, (r^2 + rR + R^2)$$

in which $r = 1\frac{1}{2}$ inches and $R = \frac{7}{8}$ inches.

(6) R. M. C. asks for details of a 14 inch hollow wall, designed to keep out the damp. A. Such a wall is formed of two casings with a space 2 inches wide between them, the outside casing being one brick, or 8 inches, in thickness and the inside casing half brick, or 4 inches. The bricks of each casing are laid in the ordinary manner, either in the usual running bond or, if it is preferred, in Flemish bond. The two casings are connected together by the insertion of galvanized iron or other ties in every fourth course in height and at distances apart of about 30 inches. Ties are manufactured for the purpose in various designs. The base of the wall is built solid up from the footings to just above the ground line, where it is covered on top with a damp course of asphalt or some other suitable material, impervious to moisture. The casings are then built upon the asphalt with the two inch space between them, forming a gutter to receive and carry away any water that may get in. This gutter is constructed with a slight fall and is connected with the drains. Care must be taken to place over every window and door frame a strip of sheet lead or zinc of a width a little greater than that of the frame, so that any water which may fall upon it shall drip off into the gutter below. A house built with hollow walls, properly constructed of good materials, will be perfectly dry.

(7) G. W. asks what it is that is put on paper, so, when you breathe on it, it will in a few seconds blaze up in a flame. A. Perhaps it may be phosphorus. Whatever it may be, our advice is to leave it alone. It cannot be a desirable article to have around.

(8) E. C. M. says: In your issue of March 6, query No. 32, W. T. W. A. asks for a remedy for ingrown nails. An excellent one, affording almost immediate relief, is the following, viz.: With a piece of glass or a file scrape along the top of the nail until it is very thin in a line with the toe; then, if the nail be too long, cut away some of the middle part of the edge only. By these means the nail is rendered elastic and yielding, and the corners are relieved from the pressure that caused the pain and inflammation.

(9) A. B. asks what to wash lamp chimneys in so they will not crack. A. Place the chimneys in cold water, and then gradually heat until the boiling point is reached, then allow them to cool slowly. By repeating this operation several times, the glass will become thoroughly annealed, and no fear of cracking need be had.

(10) G. S. asks: 1. What will stick sheet lead to cardboard? A. See list of "Cements" given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158. 2. Is there any way to cure dreaming? A. Do not lie on your back, and be careful to keep your stomach in good condition. Children sometimes have articles tied to them, so they will not turn over on their backs while asleep, as a preventive of disturbing dreams. 3. In what proportions is tincture of cantharides used for the hair, and how is it to be applied? A. Scald black tea, 2 ounces, with 1 gallon of boiling water, strain, and add 3 ounces glycerine, tincture of cantharides ½ ounce, bay rum 1 quart. Mix well, and perfume. Apply by rubbing on the head.

(11) W. W. N. asks for the component parts of Leclanche battery porous cup and prism. A. Manganese dioxide and carbon (graphite or powdered coke) with dust sifted out, are used about half and half for porous cup. For prisms, a paste of 40 parts manganese dioxide, 52 of carbon, 5 of gum lac, and 3 of bisulphate of potash, is compressed by a pressure of 300 atmospheres, at 100° C.

(12) J. H.—Alum gives excellent results when it has been found desirable to clarify muddy or turbid waters. Ammonia water will precipitate all iron in solution, but is not likely to be as successful a clarifying agent.

(13) L. D. P. asks what to add to nickel solution of double sulphate and ammonia to throw down any copper or iron that may be in it. Also, what will throw down the nickel itself? A. If the solution is acid, any copper present will be precipitated by hydrogen sulphide. Ammonia sulphide will precipitate nickel. See any work on qualitative analysis.

(14) J. L. D. asks: What will take the place of common reddish shellac, that is, colorless or nearly so? The coating desired should be waterproof, and not dissolve at a test of 110° Fah. Should be tasteless. A. Try gum sandarac 1 pound, clear turpentine 6 ounces, rectified spirit (65 over proof) 3 pints; dissolve. India rubber cut in fine shreds and dissolved in carbon disulphide or chloroform forms an excellent waterproof varnish.

(15) N. L. S. writes: How do minstrels use cork to blacken their faces and hands, and what makes it shine?

A. Take best lampblack ..... 1 grain.
Cacao butter ..... 6 grains.
Oil of neroli ..... 5 drops.

Melt the cacao butter, add the lampblack, and while cooling make an intimate mixture, adding the perfume toward the last.

(16) F. B. writes: In refinishing furniture, I know of no way to remove ink stains. Can you give me a simple method? A. Mix 6 ounces of spirit of salt and ½ ounce of powdered salt of lemons. Drop a little of this mixture on the stains, and rub well with a cork until they disappear, then wash off with cold water.

(17) Information desires the composition used for making silicate slates. A. We should think they could be made with pulverized slate or quartz moistened to the consistency of a thick fluid with water glass, and colored with powdered charcoal or boneblack. Then apply with a brush like a paint to the required surface.

(18) A. L. Z. asks: What is the best method of collecting very fine, flat, scaly gold from an auriferous sandbank? A. Wash it through sluice ways or troughs over mercury, and then distill the mercury, leaving the gold behind. Simple pan washing will answer if the gold is in small quantities.

(19) W. H. T.—The removal of superfluous hair from skin is possible both by means of depilatories and by electricity. The former are mostly preparations of sulphide of barium or sulphide of calcium, and the process by electricity is very slow, each hair root having to be killed separately.

(20) J. W. asks (1) whether the smoke of tobacco which has been filtered through cotton batting is rendered comparatively harmless. A. It is certainly rendered less poisonous, but the "comparative harmlessness" depends upon the individual. 2. How many candle power lamp of an incandescent electric lamp will be equal to a common gas flame? A. An ordinary burner consuming 5 feet of the New York Gas Company's gas per hour gives a light equal to 23 candles, while the ordinary Edison incandescent lamp burns with a brilliancy equal only to 16 candles.

(21) J. F. writes: I have in use porcelain enameled jacket kettles for melting beeswax from which the enamel has come off partly; how can I repair the kettles? A. It is not likely that the defective portions can be repaired. The enameling is baked on the iron, and so when broken cannot well be replaced unless the entire enamel is removed.

(22) E. F. S. writes: I wish to obtain information on bluing iron so it will be durable; some riding bridle bits that are inlaid with silver. What process must I use? A. We know of nothing but heat for bluing that will be permanent. The heat will also tarnish the silver inlaying. We can only recommend you to polish the whole bit.

(23) B. E. T. B. asks (1) for the best recipe for stereotyper's paste. A paste for paper that is highly adhesive, and that will stand considerable heat. A. We are advised by one of the large stereotype makers that the paste is composed of the following ingredients: Water, flour, starch, gum arabic,

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alum, and whiting. The best of flour and starch are to be used. These foregoing articles, excepting the whiting, are thoroughly mixed, and heated by steam. When the mass is thoroughly homogeneous, sufficient whiting is added to give stiffness. 2. Some preparation that will fasten celluloid to iron or wood. A. Take of:

Gum shellac	1 ounce.
Camphor	1 "
Alcohol	4 "

Dissolve and filter.

(24) G. O. asks whether there is any difference in the pressure on the slides of an engine whether the engine runs over or under. A. When the engine runs over (as it is called), or the upper half crank stroke is from the cylinder, the whole pressure is down, while in the opposite direction it is upward. If the slides are over and under the rod, as in a locomotive, the pressure is against the upper slide in running ahead, and *vice versa*.

(25) F. A. G. asks the most practical way of driving a countershaft at right angle with main line, and on same level. A. Use a belt held at the desired angle by two idler pulleys on vertical shaft. They are sold by machinery dealers. Bevel friction pulleys are not reliable.

(26) E. E. R.—There is no blacking you can put on a stove to keep it blacked that will not burn off if the stove gets red hot.

(27) J. D. B.—The refractive index of a few liquids is as follows: Water 1·336, alcohol 1·372, muriatic acid 1·410, nitric acid 1·410, sulphuric acid 1·434, olive oil 1·470, oil of turpentine 1·475, cajeput oil 1·483, castor oil 1·490, beech nut oil 1·500, balsam copivi 1·528, Canada balsam 1·549, oil of cloves 1·535, oil of aniseseed 1·601, balsam of tolu 1·628, oil of cassia 1·641, sulphuret of carbon 1·768.

(28) H. E. H. asks: 1. Can a spring motor like those described in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 142, 146, 147, 148, and 150, be made to propel a small boat (a Barnegat sneak boat about 10 or 12 feet long)? A. Probably a spring motor could be arranged to drive a small boat for a short distance; but we think it would be easier to row the boat than to wind the motor. 2. Can you give me the address of any one that could make them for me? A. We do not know of any one regularly engaged in the manufacture of spring motors. 3. Do you think the motor advertised by the Electro-Dynamic Company of Philadelphia in SCIENTIFIC AMERICAN EXPORT EDITION for September, 1885, page 206, would do? I want to use this boat for fishing and hunting. A. It is hardly large enough for your purpose, but possibly the same company can provide you with an electric motor which would answer.

(29) E. G. H. asks: 1. What will be the result if a rubber balloon is partly filled with air, and a vacuum produced around it? A. The air in the bag will expand. 2. A recipe for a good liquid glue for small woodwork, inlaid work, etc. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 14.

(30) J. G. writes: 1. Can you give me usual proportions of each article used in compounding benzine drier, also of turpentine drier? A. The addition of certain chemical substances rich in oxygen, such as borate of manganese, litharge, minium, etc., with turpentine constitutes driers. The benzine is said to be used in partially replacing the turpentine when the so-called benzine drier is made. The proportions vary with different manufacturers, and it is impossible to obtain exact formulas. See Condit's Painting and Painters' Materials. 2. What is the simplest and cheapest method you know of for lighting gas by electricity for family use on small scale, say 4 to 8 burners? What appliances do you know of for facilitating use of personal electricity in lighting gas with the finger after collecting electricity by friction of feet on a carpet? A. We know of no simple electric lighter as asked for; the ordinary electric lighter is covered by numerous patents. No appliances are used for facilitating use of personal electricity; shuffling the feet over a woolen carpet will enable any one to thus light a gas burner.

(31) P. H.—Chimneys with draught elbow on top draw only when the wind blows; at other times the draught elbow is of no value. Chimneys may be in height from 20 to 100 times their interior diameter, and should ordinarily be of equal interior size throughout.

(32) G. B. C. asks the best way to harden large steel plates, so as to keep them from springing. A. We know of no way of hardening large plates without warping. The usual way is to draw the temper and straighten with the hammer.

(33) C. E. K. writes: Can telegraph operator's paralysis, in any stage, be remedied or permanently cured by any doctor, or can it be done with gymnastic exercises in any form? A. What your arm needs is rest of its muscles. There is an incipient paralysis, caused by long and over-fatiguing use. This almost surely will increase if the same use is continued. Medicine can be of but little service. Your right hand and arm must have rest. You can do this by learning to use the left; it takes time and patience, but it can be done, and is well worth the doing, for it will free you from your trouble.

(34) C. R. W. asks information with regard to the curing of hickory, oak, and ash timber, to keep it free from the worms. A. Your cheapest method is to saturate the timber with a solution of bichloride of mercury (corrosive sublimate). Make a tight box of sufficient size, pack in the timber, and pour in the solution so as to cover all several inches deep. Let it remain twenty-four hours, and remove it. You will find that no worms will touch it. The expense is not great, for one part of the bichloride in a thousand of water is sufficient. The solution is of course poisonous, and must be kept with care, but the timber when dried is not in any way injurious to workmen or others.

(35) J. R. asks: 1. What is iron sponge, and how is it made? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 87 and 125, for spongy iron. 2. What is the temperature at which water dissociates in iron pipes? A. Water does not dissociate in this way, but is chemically decomposed, giving up its oxygen to the iron at a red heat. The temperature at which water can be dissociated has been variously placed at between 4,000° and 7,000° Fah.

(36) L. J. P. asks: 1. How many pounds will one gallon of air sustain in water? A. About 8⅓ pounds, or the weight of a gallon of water less the weight of a gallon of air. 2. Can a cord belt be manufactured so that it will be endless and have no lumps, where it is connected, to throb in passing over small pulleys? A. There are no such cords in market, but the splicing should be done so neatly that there is no perceptible throb.

(37) K. F. writes: 1. Can you tell me how to raise Canary birds? Should the male bird be kept in the same cage until the young birds are ready to fly, or should it be separated when the female is ready to sit? A. It is not necessary to separate the birds. The male generally waits on the hen bird while she is sitting. There are several books on the care of Canary birds, such as "Canary Birds; a Manual of Useful and Practical Information for Bird Fanciers," price $1.00.

(38) G. H. C. desires a positive cure for "Fetter's salt rheum." A. Wash the parts affected with Castile soap and water; dry with a soft cloth; then wet with tincture of iodine, and let it dry; after which apply citrine ointment, made by dissolving 1½ ounces mercury in 3½ ounces nitric acid. Stir till effervescence ceases. Heat 16½ ounces lard to 200° Fah. in an earthen vessel, and add the solution, stirring constantly until thoroughly amalgamated.

(39) C. E. M. asks: 1. Is there any rule for finding the proportion between the pressure required to crush or collapse a boiler and the pressure required to burst it? A. No. The form, size, and thickness of metal determine this. 2. Has there been an engine made using the electric magnet as a motive power? A. Yes; many. 3. What is the general plan of compressed air engines, and what pressure is usually used? A. Similar to steam engines. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 309. 4. What is the condition of the United States navy now? A. A great many officers, but a very poor show of vessels. See report of Secretary of the Navy. Your question on bookkeeping is too vague for answer.

(40) M. A. M. asks: 1. Why does the water of Lake Geneva, Switzerland, rise and fall so suddenly? A. From unequal barometric pressure and local winds. 2. If a piece of ice containing a large air bubble be allowed to thaw rapidly, will it thaw a particle inside so long as the walls remain intact? A. It will not. 3. At about what date in the earth's existence did the glacial period begin? A. Several million years ago. 4. Was it a sudden transition from heat to cold? A. Probably not. 5. What is supposed to have been the cause? A. Possibly and probably a change in the position of the earth's axis. 6. Has there been more than one such period? A. Supposed to have been two. 7. What book will give me the most information on the formation, changes, etc., of the earth up to the present time, in simple language, easily understood? "The whole thing in a nutshell." A. The whole thing cannot be put in a nutshell. See Dana's Geology, which we can send for $5.00, and SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1, 268, 427, 400, 419, 398, on glacial period.

(41) H. C. F. desires a method of preserving natural flowers. See answer to query 32 in SCIENTIFIC AMERICAN for October 24, 1885.

(42) C. W. McC. asks rules for centering the large speculum of a Newtonian reflector on a star. A. For centering the large mirror, remove the eyepiece, and look into the small mirror with the telescope turned to the light of the sky. Adjust the mirror so that the edge of the mouth of the tube will correspond with the edge of the mirror and the field appears round, with the small mirror in the center. 2. Do you know of any substance except selenium which, when placed in the sunlight, the light will be changed to electricity? A. Selenium does not change sunlight into electricity. Sunlight simply affects its conductivity for electricity. A thermo-electric pile, described in any work on physics, converts radiant heat, of which light is probably a modification, into electricity. It is constructed of various substances, sometimes of alternate bars of bismuth and antimony.

(43) A. B. C.—The same weight of metal forms a stronger column when hollow than when solid. If of the same diameter, the solid is the stronger under all conditions. The thinner metal of a hollow column would be more quickly affected by direct exposure to a high heat.

(44) W. D. V. B. asks: How many feet of gasoline gas is equal to 1 ton of coal for cooking purposes? A. It is very hard to get at any practical ratio, as the economy of gas in cooking arises from the ease of extinguishing it when not being used. With coal gas for each pot hole, allow eight feet per hour in burning; for each oven, double the amount. Pure gasoline gas would be consumed in smaller quantities, about one-eighth to one-tenth the above amount.

(45) T. R. G. asks: Does the stern or bow swing around when a sail boat is brought about? A. Both swing around, the boat going in a curve, and its keel keeping pretty closely to the series of chords of the curve.

(46) S. J. asks: 1. How many volumes of air are required for the complete combustion of one volume of illuminating gas in an inclosed chamber? A. It depends on the composition of the gas. For pure hydrogen, two and a half volumes; from that up to ten or fifteen for a pretty wide range of illuminating power may be taken. Ten volumes would be a good basis for coal gas. 2. What is the increased volume of air for every degree of heat added? A. None. 3. What is the proportion of air and gas used in gas engines? A. About 1 to 10. 4. Is it necessary that the mixture of gas and air should be compressed before it is exploded? A. No. 5. Will not a gas engine work with mixture of gas and air exploded without compressing? A. Yes; but not so well in engines of the present construction.

(47) H. B. N. asks: What wire and cores and how many layers of wire will make the strongest electro magnet, using six or eight cells Bunsen battery? Also, how many feet of wire it will take? A. In general terms, the larger the core, with wire correspondingly heavy, the greater would be its power. The wire should be of length sufficient to produce three or four ohms resistance. Hence its size and length would depend on the core.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

B. B.—The specimen appears to be a piece of micaceous iron ore. The value of the ore can only be determined by an assay, costing from $12.00 upward according to number of constituents determined.

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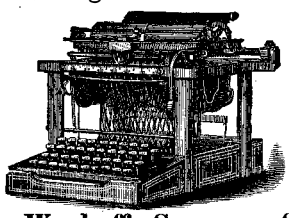

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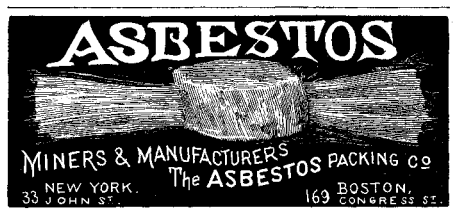

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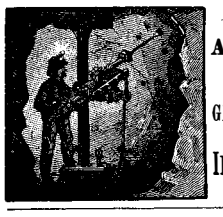

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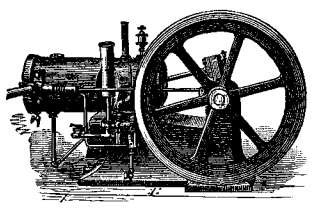

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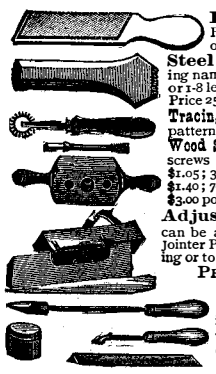

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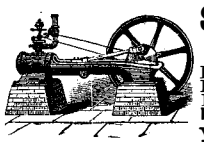

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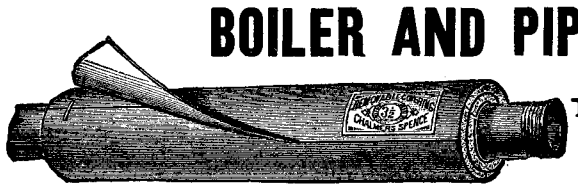

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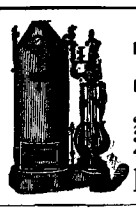

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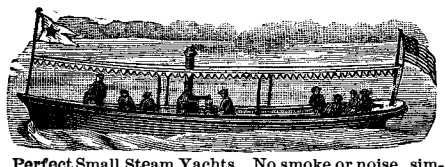

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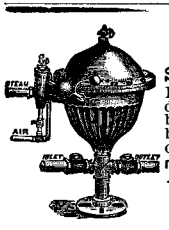

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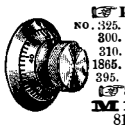

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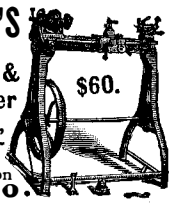

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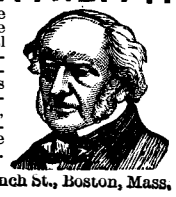

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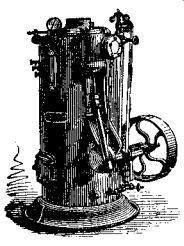

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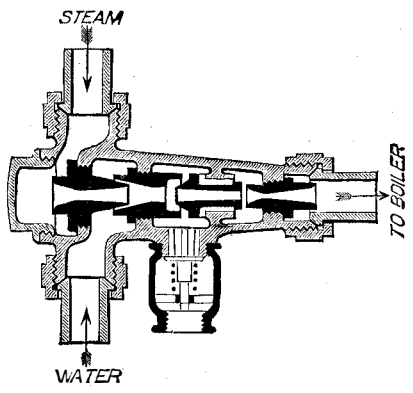

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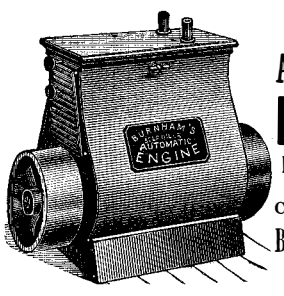

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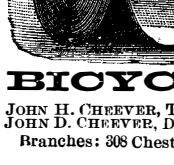

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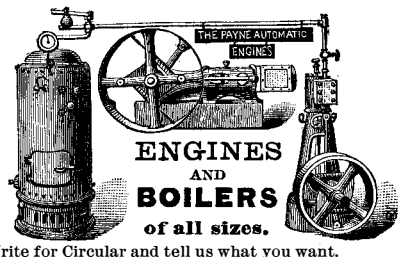

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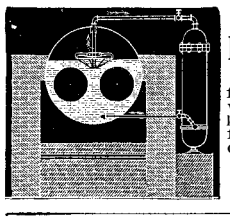

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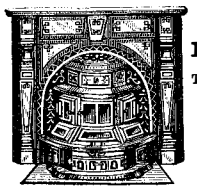

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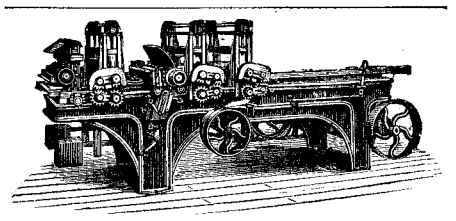

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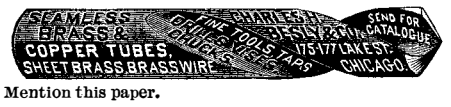

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